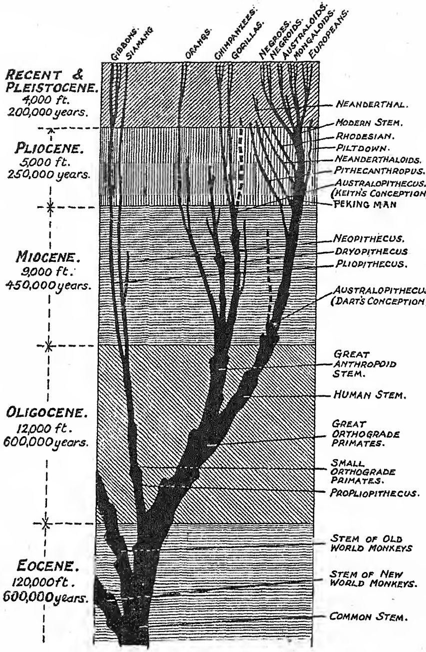
NEW DISCOVERIES
RELATING TO
THE ANTIQUITY OF MAN



DIAGRAMMATIC SYNOPSIS OF HUMAN EVOLUTION.

An Evolutionary tree of Man and Ape is represented against a background of geological time. The separation of human and anthropoid stems is represented as having taken place in the oligocene period, while the breaking up of the human stem to form species and races—known to us by fossil remains—is depicted as having occurred in the pliocene and early pleistocene periods. The divergence of the human stem towards the right is intended to indicate a steady man-ward movement.

NEW DISCOVERIES

RELATING TO

THE ANTIQUITY OF MAN

By

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ILLUSTRATIONS

TIME CHART.

INTRODUCTION

THE *Antiquity of Man* appeared as a modest single volume in October 1915; the second edition, published in January 1925, had to be divided into two volumes, so great had been the accession to our knowledge of ancient man. In the five years which have come and gone since the second edition was issued, the search for the remains of fossil man has been ardent and world-wide; discoveries have been numerous—many of them throwing a new light on the strange history of early man. To make this new knowledge available for students of Man's Antiquity two courses were open. The first was to take the second edition of the *Antiquity of Man* to pieces and build it up again, incorporating the new knowledge with the old in the process of rebuilding. The second course was to effect in that work such minor changes as were needed to bring it up to date and to issue a new book containing the discoveries of the past five years and the bearing which such discoveries have on the problem of man's evolution. It is the second course which has been adopted. Hence the publication of this volume—a completely new work—in addition to the revised edition (1929) of *The Antiquity of Man*. Such is the rate of advance we are now making in this branch of knowledge, that in five years' time my hand, or another's, will have to add a supplementary volume to the new work.

A Tour of the World in Search of Fossil Man.

The search for our early ancestors has become world-wide. When writing *The Antiquity of Man*, I began my survey in England and finished my tour of inspection by carrying my readers abroad. In this volume my procedure is reversed; our tour of the world, in search of human origins, begins in South Africa and ends in England. I chose South Africa as my first place of call for several reasons. Archaeological exploration has demonstrated the antiquity of South Africa as a home for men—men of a most strange and unexpected type. My chief reason for

selecting the great cul-de-sac of South Africa as a starting-point, however, was to examine one of the most remarkable and most puzzling of fossil beings that has ever come to light—one to which its discoverer, Professor Raymond Dart, has given the name of Australopithecus. This discovery has raised problems of a new kind—problems which at once involve us in a consideration of the place, time and mode of man's emergence from an anthropoid status. Between the lowest known form of mankind and the highest kind of anthropoid lies a wide intermediate zone which we bridge at the present time by hypothetical missing links. This intermediate and unfilled zone between anthropoid human forms has an upper or human threshold and a lower or anthropoid one. There has been much debate as to whether Pithecanthropus (Java man) falls above the upper threshold or below it; is he to be counted human or only semi-human, a kind of ape-man? The discovery of Australopithecus has carried debate to the lower threshold of the missing-link zone. Had this extinct being crossed the lower threshold and become an ape-like man, or was it to be relegated to the lower zone—to be placed with manlike apes or anthropoids? Our verdict has to be based on a minute examination of skull, jaws, teeth and brain. Chapters I–VI are devoted to a consideration of the evidence obtained from these sources and of the inferences which are to be drawn. A discussion which is so technical can be followed only by the aid of numerous illustrations. The author is greatly indebted to the publishers for liberality in this matter.

A Big-Brained Type.

Sometimes I doubt if the belief of modern anthropologists in Evolution is more than skin deep. I can best illustrate my suspicion by touching on the history of the Bushman of South Africa. Those who have investigated this peculiar race have usually assumed that he is an immigrant—that the cradle of his evolution is not where they find him—South Africa—but in some distant and

unnamed region of the earth. Yet on the evidence available—and recent archaeological discoveries in South Africa have added much to the evidence—we must suppose that evolutionary forces are just as valid in South Africa as in any part of the earth and that the Bushman has been produced in the land where we still find him. The Bushman, as my readers will learn from Chapters VII, VIII and IX, which are devoted to the prehistoric peoples of South Africa, comes of a big-brained ancestry. Philosophers, in speculating as to what mankind may ultimately become, have pictured for us beings with great heads, small jaws and diminutive bodies. We now know that such a type has already existed in South Africa; Boskop man was more richly endowed with mass of brain than any human type known to us. Yet in the race for survival big brains did not save the type; the nomad Bushman is its degenerate present-day descendant.

In discussing the prehistoric inhabitants of South Africa, three matters come up for consideration. We have to inquire how they came by their large endowments of brain. Was it because they used their brains more than people living in other parts of the earth? Or did they come by them through the working of laws of development and of growth which we do not yet understand? What use did the prehistoric Boskop folk make of their great brains? What is the significance of a large brain? Does it mean mental ability—or a power to enjoy life—or both? All these problems the reader will find touched upon in the South African chapters of this volume and in other chapters relating to early inhabitants in various parts of the ancient world.

Prehistoric Life in East Africa.

In my present survey I carry my readers from South Africa to the Rift Valley in Kenya Colony, where the East African Archaeological Expedition, under the leadership of Mr. L. S. B. Leakey, is uncovering prehistoric sites of the highest interest. All the world knows that Sir Arthur Evans, by his excavations in Crete,

restored to Europe a most important chapter which was missing from the early history of her civilization. Mr. Leakey is now doing for Africa what Sir Arthur Evans did for Europe; he has discovered and opened an altogether unexpected field of prehistory—one which is to throw light on the early spread of cultures in Africa. Kenya is a key situation. The people found by Mr. Leakey in prehistoric graves were probably the contemporaries of the Cromagnon men of Europe; in their tall stature and big brains they are reminiscent of this early European type. They certainly were not negroes, yet I suspect they were the evolutionary cousins of the negro. I regard them as proto-Hamites—forerunners of the black woolly-haired Hamitic stock still represented in the peoples of North-East Africa. In the light of the discoveries made by Mr. Leakey in the Rift Valley, there can be no longer any doubt as to the antiquity of the Oldoway man. When preparing the first edition of this work in 1914, I rejected Oldoway man, unearthed by Dr. H. Reck in what was then German East Africa, as a representative of pleistocene man; he seemed to me, from the evidence then available, to be a modern Hamite who had come to be buried in a geological deposit of pleistocene age. Seeing that Oldoway man agrees in all his features with the men discovered by Mr. Leakey in palaeolithic graves in Kenya, I have had to reconsider my opinion and acknowledge that Dr. Reck was in the right when he claimed Oldoway man as a representative of the pleistocene inhabitants of East Africa.

Palestine in Prehistoric Times.

Having surveyed the accessions made to our knowledge of prehistoric man in East Africa, I carry my readers to the Land of the Bible—Palestine. Under the aegis of the British School of Archaeology in Jerusalem the history of Palestine is being extended far beyond the days of Abraham. The early history of Palestine lies buried in the Hills of Galilee, in the mountains of Judea and in the flanks of Mount Carmel. In the limestone

caves of these ancient hills, scions of the youthful school of Anthropology of the University of Oxford—Mr. Turville Petre and Miss Dorothy Garrod—working for the British School in Jerusalem, have demonstrated that there was a time when Palestine was inhabited by men and women of the Neanderthal species and that, as in Europe, this type was replaced in later pleistocene times by people of the modern type. Having thus given Oxford its just meed of praise, it is only fair that I should be equally fair to the youthful and progressive Anthropological School of Cambridge University. Mr. Leakey is a recent product of that School. I am proud to think that in opening up the world of ancient man—in unravelling the steps which have led mankind to its present position—young British recruits are now in the van. It is right that this should be so; our search into knowledge should be as wide as our imperial responsibilities.

The Search for the Beginnings of Modern Civilization.

The caves of Palestine carry the history of man through a long period of time, a period which, according to our provisional calendar, extends from about 30,000 B.C. to about 10,000 B.C. Near the latter date, as anthropologists now suspect, man began to forsake life in caves for one in the open. The change was due to the discovery of agriculture. No trace of the transition has been found in Palestine. The search for the beginnings of agriculture, which is the basis on which our modern civilization has been reared, is more likely to be successful in Mesopotamia and Egypt than elsewhere in the world. At Ur, under Mr. Leonard Woolley, and at Kish, under Professor S. Langdon, excavators have carried the history of Mesopotamia to a point which may be dated at 4000 B.C., but even then there were ships on the Tigris and Euphrates, cities on their banks and wide expanses of wheatfields on their plains. Egypt, owing to the better preservation of her records, is more likely than Mesopotamia to reveal the steps which led man from life in caves to life in towns. Hence attention is drawn in Chapter XV

to the excavations of Mr. and Mrs. Guy Brunton. They have carried the predynastic civilization of Egypt back to a date which they assign to the middle of the 6th millennium B.C. There thus remains between the earliest predynastic Egyptian and the latest cave man of Palestine an unbridged interval of several thousand years. There is reason to think, as my readers will find in Chapter XV, that this interval may be filled up by records preserved in old lake beaches which still encircle the Fayum of Lower Egypt.

China as a Home of Ancient Man.

From Palestine I carry my readers to China. In 1925 the mainland of Asia still remained a virgin country so far as the student of prehistoric man was concerned. Father Teilhard, sent out by the *Institute de Paléontologie humaine*, has since then, in the company of Father Licent, discovered extensive hearths and workfloors of palaeolithic man buried deeply beneath the loess deposits of North-Western China. The most surprising and most important event in China, however, has been the discovery of that peculiar human being to whom Professor Davidson Black has given the name Sinanthropus, but whom we may speak of as Peking man. There are several aspects of this discovery which my readers may miss in the systematic and technical account I have given in Chapters XVI, XVII and XVIII. The first is the vast extent of the fossiliferous deposits in which the remains of Sinanthropus were found; they fill the interstices of a considerable hill. The second is that the discovery was not the result of an accident but of a systematic search carried out during the years 1927, 1928 and 1929. Rockefeller Funds provided the "sinews of war". The search was made by a highly skilled band of men enrolled from various nationalities. The anatomist, Professor Davidson Black, is a Canadian and a distinguished representative of the British School of Anatomy; the geologist and discoverer of the site is Dr. J. G. Andersson, a Swede; the archaeologist, Father Teilhard, is French;

the director of excavations, Mr. W. C. Pei, is a Chinaman, a member of the Geological Survey of China. A system of scientific co-operation has given full, precise and reliable facts concerning the nature of Peking man and of the times in which he lived. The third aspect of the discovery is the light thrown on evolving humanity. Peking man, we may suppose, represents the people who lived at the eastern end of the Old World at the beginning of the pleistocene period—250,000 years ago in our scale of reckoning (see time chart, p. 35). We know of only two other representatives of early pleistocene man—Java man (Pithecanthropus) and Piltdown man (Eoanthropus). Now, while Java man had so small a brain that there are doubts as to his essential humanity, his contemporary in England had a brain equal in size to that of many modern human beings. Because of his small primitive brain we have come to look on Pithecanthropus, not as representative of the men of his time, but as a human Okapi who had somehow come down unchanged from an earlier geological period. Hence we expected that when his contemporary on the mainland of Asia was discovered he would prove to be the equal of Piltdown man in development of brain. A surprise was in store for us. Peking man, when Professor Davidson Black dissected him out from his stony matrix, proved to be only a little higher than Pithecanthropus. Indeed, Sinanthropus is the cousin of Pithecanthropus.

The Status of Pithecanthropus.

Having dealt with the characters of Peking man, so far as we know them as yet, I carry my readers to Java to reconsider the status of Pithecanthropus. Dr. Dubois has produced a fossil fragment of lower jaw which he assigns —rightly in my opinion—to that primitive form of humanity. The fragment has on it the rudiment of a chin; it also bears the socket for the canine tooth; that tooth was human—not anthropoid—in size and shape. Pithecanthropus had a larger brain and was more human than we originally thought. Nevertheless, he was merely

approaching the threshold of humanity; Sinanthropus was on the point of crossing it. Thus Pithecanthropus is not the anomalous being we took him to be; he is nearer to the stage which evolving humanity had reached in the distant East and at the beginning of the pleistocene period than we had thought hitherto.

Parallelism in Evolution.

From Java the transition to Australia is easy. In my last survey (1925) only one discovery of fossil man had been made in Australia—that of the Talgai lad. I am convinced that Cohuna man, whose remains were found in the lower stretches of the Murray Valley and are being described by Sir Colin Mackenzie, represents the adult of the Talgai type. He is a proto-Australian—an ancestral form of the Australian aborigine of to-day. His jaws are much bigger and stronger than those of the modern aborigine; in the course of recent evolutionary changes the Australian jaws have become reduced in size. We met with similar changes in the Boskop-Bushmen type of South Africa. We meet with a corresponding reduction of jaws in Europe. The proto-Europeans—the Cromagnon and Predmost people—had larger and stronger jaws than their modern representatives. We may ascribe the reduction of European jaws to a change of diet, but such an explanation scarcely holds for South Africa and Australia. For my part, I am inclined to look upon these corresponding changes as being due, not to any alteration in mode of life, but to an inheritance derived from a common ancestor. Parallel evolution is not proved to have taken place in the evolution of human races, but the case for believing that nearly related human species can, after separation, undergo similar structural changes certainly grows in strength.

The Enigma of America.

In the vast continent of America no fossil form of fossil man has yet come to light. Hesperopithecus has

been thrown overboard.[1] With the discovery of early pleistocene man in China this becomes the more surprising, for in pliocene and pleistocene times Behring Straits was bridged by land several times. The way from the Old World to the New was open to pleistocene man if he cared to take it. He almost certainly did take it, and his fossil remains will yet be found in America. So far only one skull, the Punin skull—described in Chapter XIX—has on it the marks of antiquity. It is of a type now found amongst the aborigines of Australia.

Neanderthal Man.

Having made the tour of the world in search of recent discoveries of fossil man, I conduct my readers to Europe. Very important discoveries have been made in European countries during the last five years, particularly relating to Neanderthal man. Remains of this strange type of humanity have hitherto been found in caves or rock-shelters. Right in the heart of Germany—in travertine quarries near Weimar and in a valley deposit in the outskirts of Rome his fossil remains have now been discovered. They are preglacial Europeans. These recent discoveries carry the history of Neanderthal man far into the long temperate interval which preceded the last glaciation of Europe. The excavations made by Miss Garrod at Gibraltar reveal Neanderthal man in his closing phase; he did not perish for lack of brains. We now believe that for the greater part of the pleistocene period men of the Neanderthal species were the sole inhabitants of Europe. The homeland of this type stretched eastwards along the Mediterranean as far as Palestine and along the Black Sea as far as the Crimea.

The Colonization of Europe by Neanthropic (Modern) Man.

In a certain phase of the last ice-age the forerunners of modern Europeans—the proto-Europeans—suddenly appear; where they came from and what their lineage was are problems now exercising the minds of students of

[1] See *Antiquity of Man*, vol. ii, p. 476.

prehistoric man. They colonized Europe; Neanderthal man vanished. Readers will find the present state of knowledge concerning these important changes—the most critical in the history of Europe—discussed in Chapters XXIV, XXV, XXVI.

Rationalism Applied to Prehistoric Problems.

A century ago Sir Charles Lyell applied rationalism to the interpretation of geological problems. He sought to explain all the changes which had transformed the face of the earth in past times by calling into operation only such forces as could be demonstrated at work in the modern world. If we are to lay the study of prehistoric races on a sure basis we must adopt Sir Charles Lyell's law of uniformity. We must explain the origin of human races by calling in only those forces which could have been seen at work moulding the racial constitution of the world before modern commerce began to penetrate racial boundaries. Now in recent times we have seen certain races extending their distribution by spreading into the territory of other races and ultimately exterminating them. We suppose that this happened in Ancient Europe: Neanthropic man came in; Neanderthal man vanished.

Human races are never stable; we have been in the habit of speaking of the Egyptian of to-day as being the same man as his ancestor of 6,000 years ago. We now know this is not true: the Egyptian has changed; the peoples of Europe are not identical with the peoples who occupied the same lands a thousand years ago. The racial body is unstable; it must change with the passage of time. It is the application of this law which makes me more and more sceptical of the geological evidence which assigns a high antiquity to modern types such as are represented by Galley Hill man and the Olmo man.

Further, we must suppose that the evolution of human races has taken place in an orderly manner; each great region of the world has produced and shelters its own native type. The Eskimo is a Mongolian type which has evolved in the arctic regions of Eastern Asia and North

America. The Bushman has evolved in South Africa. Yet there are quite competent anthropologists who are prepared to believe that in late pleistocene times Eskimos and Bushmen lived in Europe. I deny the existence of Eskimos and Bushmen in Europe during late pleistocene times, not because their presence would be an offence against the law of uniformity, but because an examination of the anatomical evidence has convinced me that the fossil remains ascribed to Eskimos and Bushmen are those of men and women who have every right to the name European.

Cave Men of Britain.

Having reviewed recent additions to our knowledge of the late cave men of the Continent, I pass to England to note in Chapter XX what recent excavations have brought to light in her caves. We are coming by a considerable knowledge of the people who inhabited the caves of England towards the close of the last ice-age. There is now clear evidence that at this early date our island was being invaded by a round-headed people. Hurried visits to Scotland and to Ireland (Chapter XXVIII) reveal the fact that they, too, at the end of the glacial period, had their cave men. Brief as our visits to these countries are, they are sufficient to make us realize the transformation which 10,000 years have effected. From being the abodes of handfuls of cave-dwellers Ireland and Scotland have become homes for millions.

The London Skull.

Readers may be surprised to find that I have discussed the London skull at great length. Two chapters are devoted to it—Chapters XXIX and XXX. I look upon the London skull as the most important addition which England has made to our knowledge of prehistoric man since the first edition of *Antiquity of Man* appeared. A full consideration of the evidence has led me to transfer this skull to an older geological horizon than the discoverers have given to it, and to assign it, not as they have done,

to an unknown type of modern humanity, but to a recognized type of ancient man, viz. man of the Piltdown type.

Revival of the Piltdown Controversy.

In coming to this conclusion I fear I am throwing sparks into the smouldering fire of the Piltdown controversy. It is not the revival of controversy which disturbs me, but the fact that by coming to such a conclusion concerning the racial nature of the London skull I have had to reconsider certain major problems concerning the history of man in ancient Europe. The story of early man in Europe was becoming simple and straightforward. The Piltdown type, we had concluded, had died out leaving no issue. The remains of modern man which had been found in early pleistocene deposits of the valleys of the Thames and Seine we had cast aside as falsely dated documents. Having removed these two human types from the arena of early pleistocene Europe, the way was cleared for giving men of the Neanderthal type sole sway in the western part of the Old World from early pleistocene times until the extinction of the type in the last ice-age. It was then that Neanthropic man made his first appearance in Europe. Thus the story of early man in Europe was becoming simple and straightforward. If I am right in regarding the London woman as a lineal descendant of Piltdown man, then our story of Western man becomes complicated once more. Indeed, I think we have again to reconsider the status of Piltdown man. We had excluded him from the ancestry of modern man because of ape-like features in his jaw and teeth. With the evidence of parallel evolution before us and the presence of similar ape-like features in the lower jaw of Sinanthropus some of our objections to the ancestral position of Piltdown man disappear. We must take into account the fact that in his cranial features he was essentially of the modern type. In the light of these facts, it seems to me that the ancient man of Sussex comes very near to being the ancestor we have been in search of—the early pleistocene ancestor of modern races of mankind.

A Chapter on the Interpretation of Brain Casts.

Man is what he is because of his brain. The problem of human evolution is a brain problem. The story of the human brain has to be read from casts taken from the interior of fossil skulls. The interpretation of the hieroglyphics of brain casts is a difficult and technical art, but it is one which is to prove so important in all future inquiries concerning the evolution of ape and man, that I have thought it advisable—in spite of technical difficulties—to devote a special chapter (XXXI) to this subject.

The Machinery of Evolution.

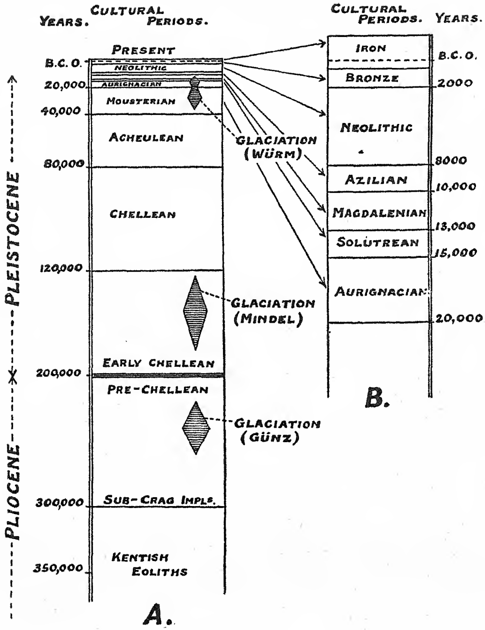
The final chapter of this volume (Chapter XXXII) is devoted to a subject of the utmost importance to students of man's evolution. This chapter I have added because of a discovery made at Gardar in Greenland by Professor F. C. C. Hansen, of Copenhagen. In a Christian cemetery of the twelfth century where early Norse colonists buried their dead, he found fragments of a skull in which were reproduced, in a pronounced degree, all the features of early palaeolithic man. To account for the presence of palaeolithic man in such surroundings three explanations may be offered: (1) that in Greenland a representative of ancient palaeolithic man had survived and part of his skull had become buried in a Norse graveyard; (2) that there had been a sudden reversion to an early evolutionary state—a manifestation of atavism; (3) that as a result of disease the glands which regulate the growth of the body had become uncontrolled in their action and that an overgrowth of all parts of the body (giantism) or of only certain parts (acromegaly) had resulted. The author has adopted the acromegalic theory. Whichever theory we adopt, we have to accept the fact that the growth of the human body and its racial differentiation are controlled by a glandular machinery, and that when we have found out how this machinery works we shall have obtained a key to the manner in which new types of mankind have been produced in the course of evolution. *Homo gardarensis*,

like Australopithecus, is a test case; both call forth the whole armamentarium of knowledge which modern students of man's evolution have at their disposal.

Time Scale.

To give order and perspective to the multitude of events dealt with in this work, the use of a provisional calendar or time chart of the pleistocene and pliocene periods of the earth's history is indispensable. In writing the first edition of *Antiquity of Man*, I adopted the time scale proposed by Professor Sollas, allowing 400,000 years to the pleistocene and 500,000 years to the pliocene period. In preparing the second edition (1925), I found reasons for reducing these allowances by half, giving to the pleistocene period a duration of 200,000 years and the pliocene 300,000. When I took into consideration the changes of climate, the extent to which the face of Europe had been altered and the transformation which had been effected in man's body during the pleistocene period, I did not think the older and more ample allowance was a bit too much. My reason for reducing the time allowance was based on the results arrived at by students of early man's stone tools, his industries or cultures. Under the more ample time allowance it was necessary to suppose that the earlier human cultures had persisted over periods measuring 40,000, 80,000 and 160,000 years. Even if we regard early palaeolithic man as non-inventive and profoundly conservative, it is difficult to believe, from what we know of the human mind, that its workings could remain so stable over such long periods of time. Even when we reduce the time allowance to half and admit that there are still great blanks in our knowledge of these ancient cultures, it requires an act of faith to believe that the human mind could run along the same groove for a period of 40,000 years.

Nothing has happened during the past five years to compel me to alter my later provisional time chart. Hence I have continued to use it in the preparation of this book and reproduce it on the opposite page for



TIME CHART.

(A) The cultural ages of the pleistocene period and of the later pliocene. A provisional estimate for the duration of each cultural age is given in terms of years. Three periods of glaciation are indicated: one pliocene, two pleistocene.

(B) A magnification of the upper part of chart (A), to show the sequence and duration of the later pleistocene cultures.

the benefit of readers. There still prevails among geologists some uncertainty as to the number of times Northern Europe became buried under ice and snow during the pleistocene period. As before, I represent only two pleistocene ice-ages—the Mindel (the first) and the Würm (the last). Whether I should have moved the Mindel glaciation to a later date and placed it between the Chellean and Acheulean cultural periods (see chart), or left it where it is now shown and introduced before the Acheulean culture an intermediate (Riss) glaciation, are matters which are still open to debate. So I have chosen to represent only two periods of glaciation in the pleistocene and let them remain as in my former chart.

Having laid before my readers the manner in which I have gathered and arranged the facts set forth in this volume and the principles which have guided me in their interpretation, there remains for me only the pleasant duty of thanking those who have made my self-imposed task possible. To give a complete list would be impossible, but I must mention some. First of all I must acknowledge my profound indebtedness to the President and Council of the Royal College of Surgeons of England. As Conservator of their Museum, they have aided me in every way in placing at my disposal the means of carrying out my studies of ancient man. Especially am I indebted for assistance from Professor Davidson Black, Miss Dorothy Garrod, Mr. Leonard Woolley, Mr. L. S. B. Leakey, Sir Colin Mackenzie, Professor Raymond Dart, Professor M. R. Drennan and Mr. B. Peers. Mr. J. Reid Moir and Mr. Leslie Armstrong have at all times placed their funds of archaeological knowledge freely at my disposal. I also gladly acknowledge my indebtedness to my publishers for their liberality in the matter of illustrations and to my young friends, Mr. Ernest Smith and Mr. Sidney Steward, for their invaluable help in preparing the original drawings reproduced throughout this volume; and to Mr. W. E. Thompson for help in preparing my text.

NEW DISCOVERIES RELATING TO THE ANTIQUITY OF MAN

CHAPTER I

THE DISCOVERY OF THE TAUNGS SKULL

THE train which carries travellers from Kimberley northwards to Bulawayo, soon after crossing the Vaal, enters

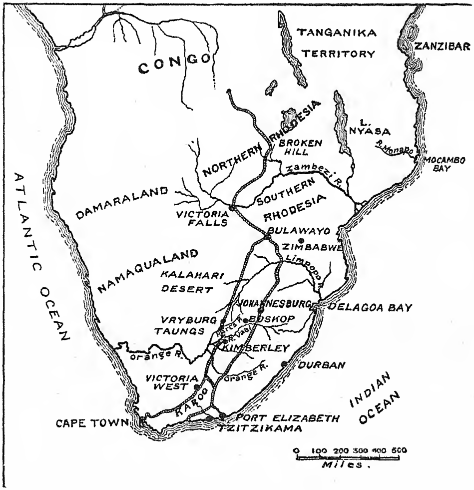


FIG. 1.—A sketch map of South Africa, showing the position of Taungs and other sites of discovery.

the wide, flat valley of the Harts River (fig. 1). The wayside station which serves the district of Taungs is passed eighty miles beyond Kimberley. Here the train

crosses the Harts River and pursues its northward course along the valley of the Dry Harts River, until Vryburg is reached. There we shall leave our travellers to pursue their journey by way of Mafeking and along the eastern fringe of the Kalahari desert and return to the Harts Valley in order that we may examine the limestone quarry

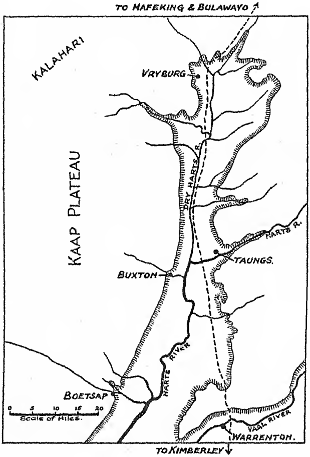


Fig. 2.—A sketch map of the Harts Valley, showing that its western margin is formed by the sharp cliff-like edge of the Kaap Plateau. (After Professor R. B. Young.)

at Buxton—the scene of the discovery of the Taungs skull. Buxton, as the accompanying sketch shows (fig. 2) is situated on the western side of the valley, near the steep margin of the Kaap Plateau, about seven miles distant from the railway station of Taungs. For twenty years a company has been working the limestone at Buxton for commercial and other purposes.

Students of ancient man are familiar with the country

into which we have now entered. In the latter part of 1924, when writing an account of ancient man in South Africa,[1] I had occasion to carry my readers to the native settlement at Taungs (fig. 2) where Mr. Neville Jones, an active servant of the London Mission, was then stationed. He was a skilled archaeologist as well as a devoted missionary. He had made discoveries which convinced all serious students of Prehistory that man had occupied sites in the Harts Valley for untold ages—for ages in every way comparable to those of Ancient

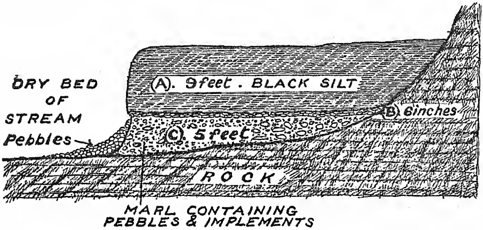


FIG. 3.—A section of the implementiferous gravels exposed on the bank of a tributary of the Harts River at Taungs. (Mr. Neville Jones.)

Europe. If we are to understand the significance of the Taungs skull, we must have a clear conception of the discoveries made by Mr. Neville Jones.[2] Close by the mission house in the native stadt he found that a small tributary stream had cut a course through ancient deposits of the Harts River. A section of those deposits is shown in fig. 3. The upper stratum, a deposit of black silt, nine feet in thickness, must be regarded as recent in a geological sense, yet it was laid down before the modern Bushmen occupied the country, for their implements lie on, not in, this deposit. Under the black silt came a thin but much more ancient stratum of marl

[1] *Antiquity of Man*, chapter xix, vol. i, p. 356.

[2] Mr. Jones has written a systematic account of his discoveries: *The Stone Age in Rhodesia* (Oxford Press, 1926). An account of his discoveries at Taungs appeared in the *Journ. Roy. Anthropol. Institute*, 1920, vol. 50, p. 412,

(fig. 3); the implements of this layer corresponding to the Mousterian of Europe (see chart, p. 35). Deeper still and resting on the bed rock was a stratum of pebbles, 5 feet in thickness; the stone implements found therein represent a stone culture parallel to the Acheulean of Europe. High up on the western side of the Dry Harts Valley, to the north of Vryburg (fig. 2), Mr. Jones found clear evidence of a still older culture—one which corresponds to the Chellean of Europe. The implements of this ancient type were found in pockets of gravel—survivals of a terrace which had been deposited on the western side of its valley by the Harts River in ancient times. Thus by the year 1920 Mr. Neville Jones had collected evidence to prove that men had inhabited the Harts Valley from the time they shaped their hand-axes of stone in the Chellean manner—a time which carries us to a remote point of the pleistocene period—down to the coming of the Bushmen. If we may apply to South Africa the chronology of Ancient Europe, and indications favour the justice of such a comparison, then we may regard the Harts Valley as the scene of human activities for the latter two-thirds of the pleistocene period and ascribe to this period a duration of at least 120,000 years (see chart, p. 35).

Before proceeding to the limestone quarry at Buxton, it will be well to note some features of the present climate of this part of South Africa. The rainy season is short and uncertain; for the greater part of the year water disappears from the stream beds of the Dry Harts Valley. The rainfall is five inches per annum. There is evidence that the climate is changing—becoming more akin to that of real desert. Mr. Neville Jones has written thus of the district: "Within the memory of middle-aged inhabitants the district was thickly wooded, and the rainfall was well distributed and sufficient. At the present day there are no trees other than the insignificant few that have been planted by Europeans, which in no way replace the millions of camel-thorn trees cut down by the natives, and used in the Kimberley mines. The veldt

now grows nothing but low scrub, and the rainfall is so small that it is but rarely that a harvest is reaped. The small amount of rain that falls is no longer spread over the whole wet season, but is practically confined to a few torrential showers at the beginning of the summer." The land into which we have come, then, is one of scrub and drought, and when we pass out of the Harts Valley and mount the Kaap Plateau to the west these conditions become still more accentuated, while in the Kalahari to the north and west we pass into an almost waterless wilderness. Drought and desert have not always been the lot of this part of South Africa; we shall have to return to this matter again, for the climatic conditions of South Africa in past times have an important bearing on the problems raised by the discovery of the Taungs skull.

In the month of November 1924, when I was toiling in London at the proofs of the first volume of *Antiquity of Man* and visiting the scenes of Mr. Neville Jones's labours in imagination, Dr. R. B. Young, professor of Geology in the University of the Witwatersrand (Johannesburg) alighted from the train at Taungs and made his way across the Harts Valley to the limestone works at Buxton (fig. 2), having business which took him that way. He had in mind, too, a request made by his colleague—the Professor of Anatomy in Johannesburg—Dr. Raymond Dart. At that time there had come into Professor Dart's hands the skull of a fossil monkey which had been obtained from the limestone quarry at Buxton. Being an eager and talented anatomist, Dr. Dart begged his colleague to visit Buxton and obtain for him, if possible, further specimens. Seeing, too, that the implements of ancient man were so rife in the Harts Valley, it was highly probable that the fossil remains of the people who had shaped these implements might be encountered in the hidden caves of the limestone—just as in 1921 Rhodesian man came to light in the depths of the mine at Broken Hill.

The scene which met Dr. Young's eyes as he entered

the quarry at Buxton in November 1924 may be realized from the sketch reproduced in fig. 4. The working face of the rock—a modified or secondary kind of limestone—the nature of which we shall deal with presently—was then about 70 feet in height and represented the edge or escarpment of the Kaap Plateau. As may be seen from the sketch, vertical, irregular fissures descended at

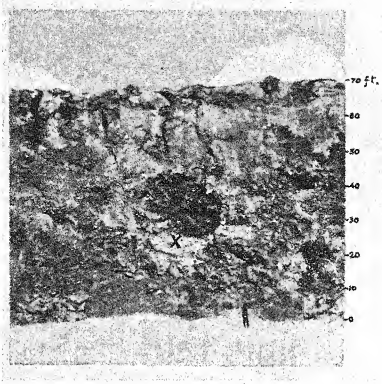


FIG. 4.—The face of the limestone quarry at Buxton (S.A.) as it appeared towards the end of 1924. The filled-in cave, whence the Taungs skull came, is shown above X. The height of the cliff is indicated in feet.

many points from the edge of the plateau, so that surface water, were it present, could percolate into the crevices and wash down the surface soil, sand and such loose objects as might be in the vicinity. The prevailing colour of the rock face was white, but here and there were large irregular patches of a brown or red colour—several of these being shown in the sketch. The centre of such a patch was made up of loosely bedded sands laid down by an obliterated underground stream; towards the peri-

phery of such a patch, some of which were as much as 20 feet in diameter, the sand became mixed with a solid infiltration of the limestone, forming a hard rock or travertine. Such patches had clearly arisen from the filling up of underground channels and passages. At one time the original rock had been honeycombed with underground channels, passages and caves.

At the time of Dr. Young's visit the working-face of the quarry had been carried about 250 feet into the plateau; the quarry-men were familiar with the brown patches. Their windings and interlacements could be followed as the working-face of the quarry was advanced; several were exposed when Dr. Young arrived, but we need take notice of only one of them—that marked by a cross in fig. 4. It had a diameter of about 10 feet; its upper margin or roof lay some 40 feet below the edge of the plateau; its lower margin or floor some 20 feet above the bottom of the quarry. A shot, just fired, had blasted away and brought down a mass of material which included the area of the "brown-patch" —the contents of an obliterated passage or cave. The workmen knew it was in such material that fossil bones were most likely to be found. In this instance they were not disappointed; the manager of the lime-works gathered certain blocks containing fossil fragments from the fallen debris and handed them to Dr. Young, who in due course carried them to his colleague Dr. Dart in Johannesburg. Presently we shall visit that city to see the Taungs skull unveiled. In the meantime we shall stay behind at the quarry and ascertain from Dr. Young[1] how and when it was possible for animals to become so deeply entombed in the limestone cliff at Buxton.

It is worth our pains to understand how the calcareous tufa or travertine which is quarried at Buxton came to be formed. It is rock of this kind which preserves fossil remains for us in their most perfect state. We shall see,

[1] Dr. R. B. Young, "The Calcareous Tufa Deposits of the Campbell Rand from Boetsap to Taungs Native Reserve" *Trans. Geol. Soc. of South Africa*, 1925, vol. 28, p. 55.

in another chapter, that travertine quarries near Weimar have just yielded—at a depth of 40 feet—fossil bones of man and a complete record of his manner of life. Fortunately at Weimar we can assign a definite date to the process of entombment; it took place somewhere towards the end of the middle third of the pleistocene period—which tells us that tufa deposits may form at a rapid rate. We shall see that at Buxton the limestone cliffs and particularly the caves and passages by which they were honeycombed, need not be so ancient in origin as one is inclined to suppose at first thought.

The limestone quarried at Buxton is really an excresence which has grown out from the original face of the Kaap Plateau. That plateau is composed of dolomitic limestone. Everywhere it is tunnelled by underground springs whose waters are charged with lime in solution. Dr. Young observed that where springs issued from the cliff face of the plateau the water parted with its lime as it trickled over the face of the cliff; where water was more abundant, the lime deposits became more extensive; the limestone cliffs at Buxton had grown out in this manner—laid down by percolating streams. The streams, as they advanced the cliff by laying down fresh deposits on its edge, still kept their channels open. On the surface of the plateau there can now be traced many ancient stream beds showing that in past times the rainfall in this region must have been considerable and that the underground streams must have been full in the rainy seasons with a power to erode new tunnels and caves, while in the dry season they would freely discharge their burden of lime as they issued and spread over the growing face of the cliff. In such a way did the tufa cliffs at Buxton—with their passages and caves—come into existence.

If we ask when the caves and passages became filled up so that the remains of animals were entombed within them, we have—so far as I know—only one reliable line of evidence to guide us. Altogether there have been recovered from these filled-in caves at Buxton the fossil

skulls of nearly a score of apes. Some of these have been described by Dr. S. H. Haughton of the South African Museum, Capetown; others are being investigated by Mr. J. H. S. Gear,[1] a pupil of Professor Dart's. Now, all of the monkey skulls so found represent kinds of baboon which were not markedly different from the species which still abounds in South Africa—*Papio porcarius*. Mr. Gear, who studied fourteen fossil specimens, found that they represented at least two species of baboons, both of them smaller in size and less robust in development than the present baboon of South Africa (*Papio porcarius*) and more generalized in type. The living species has great muscles of mastication, strong bony ridges on face and skull, robust teeth and large brain; in all these respects the fossil animals were the weaker and smaller. Nevertheless the points wherein the fossil baboons differ from those still living relate to details in form and size of tooth, brain, muscle and bone; on the anatomical evidence we may justly infer that these fossil apes, which were the contemporaries of the Taungs anthropoid, represent early pleistocene forms or, at the most, late pliocene. Indeed it is possible, if not probable, that when the Taungs skull became embedded in a cave at Buxton, fully evolved man was already an inhabitant of the Harts Valley. Dr. Young found baboons still frequenting caves on the edge of the escarpment a few miles to the south of Buxton.

We may, however, explain the entombment of these fossil baboons and the Taungs skull in another manner —an explanation which is favoured by Dr. Robert Broom[2] and by Professor Dart.[3] They are of opinion that these fossil remains may have become embedded in the growing face of the cliff—in the freshly formed tufa. If this were so then we must infer that, after the enclosure of the Taungs skull in the "brown patch"

[1] "A preliminary account of the baboon remains from Taungs", *South African Journ. of Science*, 1926, vol. 23, p. 731.
[2] *Natural History*, 1925, vol. 25, p. 409; *Nature*, 1925, vol. 115, p. 569.
[3] "Taungs and its Significance", *Natural History*, 1925, vol. 26, p. 315.

where the miners found it, the cliff had kept advancing until 250 additional feet had been laid down. Even if the calcareous tufa was deposited at a considerable rate —so that the growing face of the escarpment advanced a foot for every century—then we must postulate a considerable antiquity for the embedded fossils—a quarter of a million of years. As Dr. Young has pointed out, vast changes have taken place in the escarpment at Buxton after the formation of the tufa cliffs; since their deposition a neighbouring stream, which issues from the plateau at Buxton, has cut a deep ravine in the cliff, and has also had time to alter its course and cut a new channel. Even if we regard the animals as having been entombed in this way, it is difficult to believe, on the evidence just cited, that they are older than the beginning of the pleistocene period.[1]

[1] After this chapter was written there appeared in *Nature* (May 31, 1930, p. 814) a statement by Dr. Robert Broom relating to the age of the fauna entombed at Buxton. In his opinion the fossil species of baboons are not "very closely allied to any living forms" and are of a "primitive type". He finds also that in the fauna, contemporary with the Taungs anthropoid, there were:—a primitive form of hyrax, a giant rodent mole, a small spring hare and three forms of antelopes—all of them representatives of extinct species. Dr. Broom is convinced that the fauna indicates that the entombment of the Taungs skull must be attributed to not a pleistocene but a pliocene date . . . "quite likely to be Lower Pliocene".

CHAPTER II

THE UNVEILING OF THE TAUNGS SKULL—THE LIFE PERIODS OF MAN AND APE

On returning to Johannesburg Dr. Young handed the precious cargo gathered at Buxton to his colleague, Professor Dart. Amongst the fragments of limestone the anatomist recognized two further fossil skulls of the baboon variety, but there was a third specimen which immediately seized his attention. It was a moulded piece of limestone which he perceived had been laid down within a skull much larger than a monkey's and preserving an exact impression of the greater part of its cavity and thus reproducing the external markings of the brain which had occupied the cavity. The skull which had given rise to such a cast was clearly not that of a baboon; the cast was much too large and highly evolved to have such an origin. Professor Dart next observed that the frontal end of the cast was the counterpart of a hollow in another block of limestone. In this block he could see traces of a lower jaw and other facial bones. He set to work upon the cement-like material enclosing the fossil bones and succeeded, by the exercise of great patience and skill, in uncovering the face which went with the brain cast. When he had fitted brain and face together he had before him the head of the being represented in figs. 5 and 6. It will be seen that while the face and forehead are nearly complete, the actual covering bones of the skull are missing; they had been shattered and lost in the act of blasting. Further it will be noted that the brain cast itself is not complete; the greater part of the left half is missing; the left half of the skull had never been filled. We must infer that when entombed the skull lay on its right side and hence the cast was formed in the deeper or right half of the brain-chamber. Behind the forehead, however, the cast mounted above the middle line and thus the anterior parts of both frontal lobes were represented.

As Professor Dart removed the hard cement-like deposit from the jaws, he found evidence of the animal's immaturity. The teeth corresponded in number and arrangement to those of a six-year-old child. All the milk

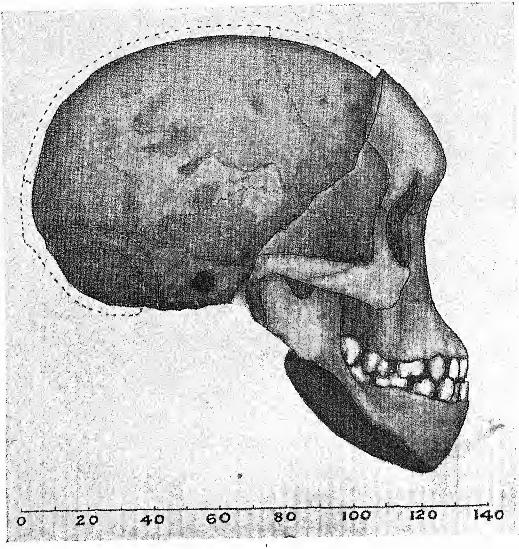


Fig. 5.—Australopithecus in profile. Two-thirds natural size from a cast. Scale in millimetres (E. Smith.).

teeth were present and to the milk set had been added the first of the permanent teeth—the 4 first molars, so that in the mouth there were altogether 24 teeth—20 milk and 4 permanent. It was plain to Professor Dart, however, that the being he had to identify was not human; brain and skull forbade such an interpreta-

tion. When compared with all living forms there remained no doubt that he had before him the fossil remains of an immature member—a child—of the "great anthropoid" type—a type now represented by the gorilla, chimpanzee and orang—the two former being natives

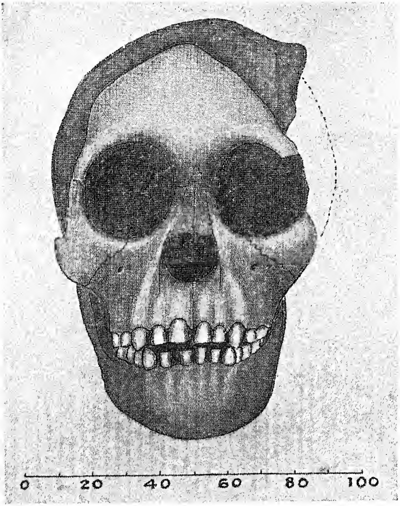


FIG. 6.—Full-face view of the Taungs skull. It is shown oriented on the Frankfort plane. Two-thirds natural size. (E. Smith.)

of tropical Africa, the other of tropical Borneo and Sumatra. In its main lines the Taungs skull was cast on anthropoid lines, and yet in certain points of face, jaw and brain it was, in Professor Dart's opinion, rather human than anthropoid. He therefore inferred that the being which had come to light in his laboratory must be lifted from the category of anthropoids and

given a place between the highest anthropoids and the lowest known form of humanity. To this extinct group of "man-like" apes he gave the generic name of Australopithecus. To the species which had lived in South Africa, of which the skull entombed at Buxton was the sole evidence, he gave the name *Australopithecus africanus.* It is worthy of note here that Taungs lies 1,500 miles distant from the homes of the gorilla and chimpanzee and much of the intervening distance is arid and inhos-

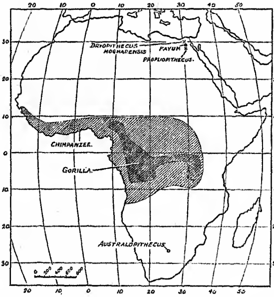


FIG. 7.—A sketch map of Africa showing the distribution of the gorilla (cross-hatched), chimpanzee (oblique lines). The sites of discovery of Australopithecus, Dryopithecus and Propliopithecus are also marked.

pitable. Until Professor Dart's discovery we had no suspicion that South Africa had ever been the home of man-like apes (fig. 7).

Before we set out to describe and analyse the structural features of Australopithecus, weighing its anthropoid traits against those which are humanoid, let us first ascertain the place we are to give it in man's evolutionary tree. In taking matters in this order we shall at once come face to face with interesting issues raised by the discoveries at Taungs. In the frontispiece of this volume is reproduced a family tree of the higher primates, which in its main lines I constructed some thirty years ago to

explain the thousands of relevant facts known to zoologists at the end of the nineteenth century. Such a tree is merely an anatomist's working hypothesis; a discovery may be made any day which will compel us to take this tree to pieces and reconstruct it—stem and branch. So far the many discoveries which have been made in the present century have fitted into it without any undue

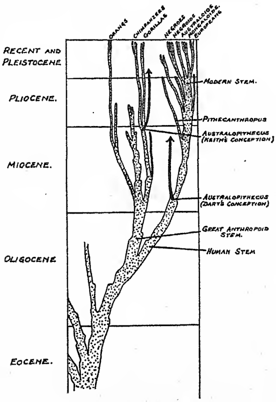


Fig. 8.—From the evolutionary tree represented in the frontispiece. Into the diagram has been inserted the place which Professor Dart would give to Australopithecus, and also the place assigned to it by the author.

constraint or distortion of fact. In keeping with our present knowledge, the anthropoid and humanoid stems are shown in this tree as parting company when the later deposits of the oligocene period were being laid down. The fossil forms which represent this stage in the evolution of anthropoid and of man have not yet been found; their existence is inferred from what we know of older and later fossil forms. In the deposits of the succeeding period—the miocene (fig. 8)—the fossil

traces of anthropoids are numerous; hence the anthropoid stem is shown as dividing into many branches in this period. The fossil traces of the human stem are mostly of pleistocene date; to explain their presence we have to postulate divisions of the human stem in the pliocene—the period which followed the miocene and preceded the pleistocene (see fig. 8).

Where, then, in such an evolutionary scheme, are we to place Australopithecus? As he exposed one feature after another from the limestone block, Professor Dart became more and more convinced that the being he had to do with must be given a place in or near the base of the human stem.[1] For him the date at which the Taungs infant lived was immaterial; the important fact was that it "typified" the basal ancestry of the human stock. Hence when he gave his conception a diagrammatic representation,[2] all branches of humanity, living and extinct, were made to emerge from an Australopithecus ancestry. In fig. 8, in which part of the evolutionary tree shown in the frontispiece is reproduced, I have inserted the place thus given to Australopithecus towards the base of the human stem. If this conception is the true one, then the discovery of the Taungs skull is an event of the very first importance, for it reveals a very early and critical stage in the evolution of the primate stem—one which gave the world its family of humanity—a stage which has been long postulated but of which no trace had come to light.

[1] Professor Dart carried out his original examination and report on Australopithecus with remarkable expedition. The limestone blocks containing its fossil remains reached him at the end of November 1924. By the middle of January 1925 he had exposed and reconstructed the skull, carried out his inquiries and written a preliminary report which appeared in *Nature*, February 7, 1925, p. 195. Other facts were added in a paper which appeared in *Natural History*, 1926, vol. 26, p. 315. A correspondence relating to the status of Australopithecus appeared in *Nature*, July 4, 1925, p. 11 (Keith), and September 26, 1925, p. 462 (Dart and Keith). In the same Journal appeared an article on Australopithecus by Professor Sollas (June 13, 1925, p. 908) supporting Professor Dart's conclusions, and in August 18, 1925, p. 569, another by Dr. Robert Broom, in which new details relating to character of skull and teeth were recorded and an opinion expressed as to the geological age.

[2] *Illustrated London News*, June 13, 1925, p. 1154.

On the other hand, a careful analysis of all the known features of the Taungs skull and brain cast has led many anatomists, including myself, to give Australopithecus quite a different place in the evolutionary tree. In all its essential features Australopithecus is an anthropoid ape. It shares so many features with the two surviving African anthropoids—the gorilla and chimpanzee—that, to account for their common heritage, we must suppose that all three have come from the same stem. The features wherein Australopithecus departs from living African anthropoids and makes an approach towards man cannot be permitted to outweigh the predominance of its anthropoid affinities.

No discovery of recent date has so tested the resources of the student of man's history as this made at Taungs; we cannot dismiss the skull in a short chapter; it raises too many critical issues for superficial treatment. If the skull had been that of an adult animal, it would have been easy to determine the position of Australopithecus amongst the higher primates. We should then have been in a position to answer the question: How big was the brain of Australopithecus? The brain of man greatly exceeds that of all other primates; it has made man the dominant animal of the world; the essential problem of man's evolution is the remarkable expansion of his brain—in size, in complexity and in power. To what extent did this Taungs anthropoid make an approach to the brain development of man? The answer to this question will help us to determine the affinities of this extinct form of being. Before an answer can be given we must first determine the stage of growth which had been reached by the immature specimen—the only one at our disposal. We can make a precise estimate of the volume which the brain had attained in this particular example of the Taungs anthropoid; what we have to determine is the size which the brain would have attained had the animal lived and become adult.

The best guide to the stage of growth—the age reached—by the youthful Taungs primate is the state

of its teeth. What do we know concerning the dates at which the teeth of man and ape cut the gums and come into use? In fig. 9 I give a diagrammatic representation of the present state of knowledge. We know with some degree of accuracy the dates at which the teeth of man erupt. We expect those of the milk set to begin when a baby is 6 months of age and all 20 teeth of this set to be in place when the child is $2\frac{1}{2}$ years of age. The eruption of the milk teeth in the human young covers

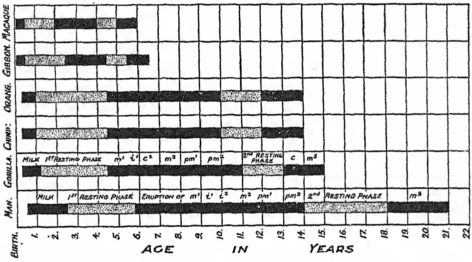


FIG. 9.—A diagram to show the periods of eruption of the milk and permanent teeth in man and anthropoid apes. There are five periods of dentition shown in each animal: (1) eruption of the milk teeth (black); (2) a first resting stage (stippled); (3) the first stage of eruption of the permanent teeth (black); (4) second resting phase; (5) final phase of eruption (black). (Further explanation in text.)

a period of 24 months, usually beginning at the end of the 6th and finishing at the end of the 30th month, but we also know that no two children are exactly alike in this matter; eruption may begin earlier or later and finish earlier or later than the mean represented in Fig. 9. After the milk teeth are in place comes a period of rest which lasts until the latter part of the 6th year when the advance guard of the permanent dentition—the 4 first molars begin to appear and are added to the milk teeth. Early in the 7th year the first permanent molars are fully erupted and in use. Thereafter follows a period of great dental activity which lasts until the end

of the 14th year; during this period the milk teeth are replaced and the second molars added, so that at the end of this period there are present 28 permanent teeth (fig. 9). Then follows another resting period until the third molars or wisdom teeth appear between the 18th and 21st year. The wisdom teeth represent the rear-guard of the permanent dentition. The reader must not think that the permanent teeth always appear "according to plan"; there is a wealth of variety in the order and in the time of appearance.[1] In 30 per cent. of Europeans the wisdom teeth fail to develop, or if developed their crowns remain locked up in the jaws.

Such are the dental periods in the white races of mankind; in dark-skinned races teeth erupt at somewhat earlier stages. In the great anthropoids—the gorilla, chimpanzee and orang—as may be seen from fig. 9, the same periods of dentition are to be observed as in man, but they are shorter in their duration and happen rather earlier in the age of the animal. No one has ever followed the life history of an ape from birth to full growth; our knowledge of their periods of dentition and of life are founded on scattered chance records made on animals in captivity. We have also systematic records of the changes to be observed in large collections of immature skulls which have been assembled in our museums; they provide grounds of inference. From such observations[2] we infer that the milk teeth in the young of anthropoid apes begin to appear in the 3rd month and that the set is complete by the end of the 1st year, or early in the 2nd year. In the eruption of teeth

[1] See *Dentition as a Measure of Maturity*, by Psyche Cattell, Harvard University Press, 1928.

[2] In the case of a chimpanzee born in captivity it is recorded by Dr. L. Montedon (*Bull. Soc. d'Anthrop.*, Paris, 1928, vol. 9, p. 14) that the milk incisors began to appear in the 2nd month after birth and that the set was complete by the end of the 6th month. This record is so out of keeping with what is known that I think it probable an error has been made as to the date at which the last milk molars erupted. The observations made by Dr. Garold C. Bingham—as to the period occupied by the eruption of milk dentition in chimpanzees—are more in keeping with my estimates (*Amer. Journ. Physic. Anthrop.*, 1929, vol. 13, p. 433).

anthropoids are more precocious than human beings; the milk dentition appears three months earlier and the process of eruption which occupies two years in the human child is gone through in half that time in anthropoid children. Then, after the milk set is complete, ensues a resting period—which we should expect to be much shorter than in human beings. From data I have collected I inferred that this resting phase lasted until about the end of the 4th year, when the first permanent molars were added to the milk teeth. The Taungs child had reached this stage of its dental progress. In order to arrive at a more precise estimate of the age of the Taungs child, Dr. S. Zuckerman[1] has made detailed observations on young chimpanzees living in the Zoological Gardens, London. There are so many resemblances between the young Australopithecus and the young chimpanzee that we may reasonably measure its life periods by those of chimpanzees. What he has observed has led him to conclude that the first molar teeth—the heralds of the permanent dentition—erupt in anthropoids as in man—at the end of the 6th year and that the process is not complete until the 15th year or later. Dr. Zuckerman would be the first to acknowledge that his observations were made on captive animals and that captivity tends to disorganize and delay the process of eruption and that in none of the five animals observed was the precise age known. Therefore I presume, on the strength of other evidence collected by me, that the great anthropoids, and the inference should be applicable to Australopithecus, reached maturity of body four or five years earlier than is the case in human beings and that their total life periods are correspondingly shorter. As fig. 9 illustrates, my present belief is that the permanent teeth begin to appear early in the 5th year,[2]

[1] "Age Changes in Chimpanzees", *Proc. Zool. Soc., London*, 1928, p. 1.

[2] Since the above was written Dr. Bingham has published observations made on four young chimpanzees kept in captivity at Yale University. He finds the first permanent molar teeth erupt in the 3rd year and that the first stage in the eruption of the permanent teeth is finished before the 7th year of age is reached. (See reference on preceding page.)

that the process is hurried through until about the 9th or 10th year, when all the permanent teeth are in place save the last molars. These appear after a short resting period and the permanent set is complete by the end of the 14th year. In male animals the canines erupt with the last molars.

I have touched upon the times at which teeth erupt in some detail not only because we have to fix the age of the Taungs infant but because such an inquiry brings up for discussion a problem which has an interest not only for students of man's evolution—but for all who are interested in man's origin. When and how did man come by his span of life which, by happy chance, may extend to three-score and ten years? The total period of a full human life is three and a half times the period in which the body grows and the teeth erupt. From stray facts known to me we may infer that the total life period of the great anthropoid has a similar relation to the phase of growth; if we assign fifteen years to the growth period, then we must suppose that at 50 an anthropoid ape is about as old as a man is at 70. During the evolution of humanity the tendency appears to have been towards a prolongation of all stages of life—the stage of infancy as marked by the milk dentition; the stage of youth as measured by the eruption of the permanent teeth, and the total span of life as measured by the onset of old age. All we know of the Taungs skull leads us to believe that its owner's life periods are to be measured by our anthropoid standard.

When we pass lower in the primate scale, to the small anthropoid, represented amongst living forms by the gibbon, we find that life periods are much shorter. The young of the gibbon spends only seven months in the womb, whereas the period of gestation for the chimpanzee, as for man, is nine months. The milk teeth of the gibbon begin to appear just after birth and are all in place by the time it is 6 months old. The permanent dentition begins in the 3rd and is complete in the 7th year. A gibbon is as old at 25 as a chimpanzee is at 50.

Now the geological evidence leaves us in no doubt that the early ancestral primates were small animals; in the course of evolution there seems to have been, in favoured forms, a steady increase in bulk of body and in size of brain and with these accessions a correlated increase in the periods of growth, of maturity and of long age. The chimpanzee marks an advance on the gibbon; with the evolution of man came a further advance.

Not only has there been a tendency to prolong the periods of life as the higher primates reached their present estate, but there has been another evolutionary movement in some of the higher primates which has a very direct bearing on the interpretation of the characters of the Taungs skull. That skull has preserved certain traits of infancy to a greater extent than is the case in a chimpanzee skull of the same dental age and to a much more marked degree than that in a gorilla which has just cut its first permanent molars. In the Taungs skull we see a tendency to delay the onset of those growth movements which produce prominent supra-orbital ridges, muscular crests on the skull and massiveness of jaw. In some of the higher primates there is a tendency to prolong the characters of infancy into childhood and the characters of childhood into adolescence and adolescence into the years of maturity. In man this tendency has been carried—particularly in some races—to an extreme degree. By the working of this evolutionary process man has come by many of his most distinctive features. The more bestial traits of body—and also of mind—which have come to him by inheritance are thereby shed. This tendency to prolong the traits of youth, to transmute passing features of immaturity into permanencies is not confined to the highest primates; it is to be seen at work amongst certain genera of apes of the New World—particularly Chrysothrix, the squirrel monkey. In this respect the chimpanzee and the gorilla are contrasted forms. The growth transmutations of the gorilla are enormous; his skull, smooth and rounded in infancy, becomes crowned ultimately with great bony

crests. The chimpanzee, on the other hand, clings to more youthful features. In Australopithecus the same tendency to retention of early stages in growth was more marked than in the chimpanzee; the same tendency has become extreme in man. We must give the effects produced by the working of this law due weight when we assess the claims of Australopithecus to a place in the human phylum.

CHAPTER III

THE GROWTH OF BRAIN IN MAN AND APE

My reason for being so particular about the point of growth reached by the Taungs anthropoid will become apparent if the reader consults the annexed diagram, fig. 10. In this diagram [1] are represented characteristic phases in the growth of the human brain. Man differs from all known anthropoid apes in the remarkable expansion which his brain undergoes in the first year of life. The brain of the newly born child is not large; in an average male child born to European parents, the brain chamber measures about 330 cubic centimetres. So rapid is the growth that by the end of the 1st year the brain has expanded to fill a cavity with a capacity of 950 c.c.—the brain almost trebling its size. In the 1st year 620 c.c. are added; in the 2nd year growth is much slower; there is an increase of only 130 c.c. In the 3rd year the addition is still less—only 70 c.c. Thus at the end of the 3rd year—six months after all the milk teeth should be in place, a child's brain measures 1150 c.c.—which represents 78 per cent. of the adult size. In the 4th year the rate of increase is still slower; only 40 c.c. are added. Thereafter growth proceeds at a more or less uniform pace, 10 to 30 c.c. being laid down annually until the full size—1,480 c.c. is attained about the 19th or 20th year. Thus an average European boy, when he has reached the stage of dentition seen in the Taungs skull—which he does about the beginning of his 7th year, should have a brain capacity of 1,225 c.c.—84 per cent. of his final allowance. A girl of the same age has a cranial capacity of 1,115 c.c.—about 110 c.c. less. If we take the Australian aborigine as a representative of small-brained humanity, then we estimate that a 6-year-old boy of that

[1] This diagram is compiled from data collected by various authors—but chiefly by Berry and Porteous—who measured the heads of living children and from the head-measurements estimated the size of the brain. Consult *Brain and Mind* (1928), by Professor R. J. Berry.

race should have a cranial capacity of 1100 c.c.—and the corresponding aboriginal girl about 1000 c.c.

How does the brain development of the Taungs skull fit into the human scheme of growth? Professor Dart has

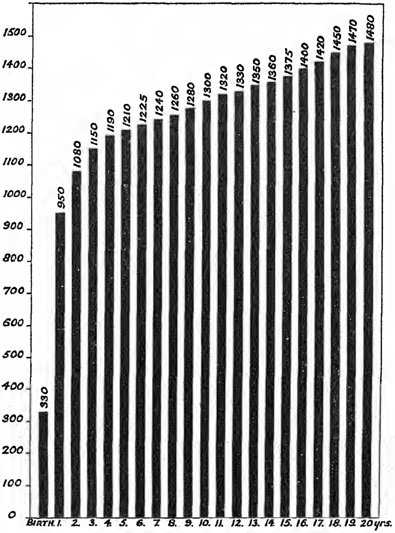


FIG. 10.—A diagram representing the growth of the human brain from birth to the twentieth year. The scale at the side represents cubic centimetres. The black columns represent mass of brain in male Europeans according to age. The diagram is founded on data collected by Berry and Porteous, and represents the mean rate of brain growth in boys of European parentage.

fixed the capacity of the Taungs skull at 520 c.c.; Dr. Zuckerman[1] has made measurements and estimates the capacity at 500 c.c. I made an exact model of half the brain in plasticine; it measured 225 c.c.—giving 450 c.c.

[1] See reference on p. 56.

as a minimum size. Taking 500 c.c. as an impartial estimate, we see that the Taungs brain cannot be fitted into any human scheme. Even in an aboriginal child of 6 years of age we expect a capacity of 1000 c.c. For a brain to reach a minimal human standard—which we may fix at 950 c.c.—it must reach the Taungs measurement, not by the 6th year but before the end of the 1st year. The astounding feature of the human brain is the rapidity of its growth in babyhood.

Now those who are best qualified to form an opinion are convinced that the human brain has been evolved from one which in size, structure and growth was altogether anthropoid. Does the Taungs brain, as Professor Dart believes, reveal to us in any degree a transitional stage in the transformation of an anthropoid into a human brain? Let us see how it fits into the anthropoid scheme of brain growth. In 1889—forty-two years ago—I became interested in the problems of brain growth in man and apes and had opportunities of making observations while sojourning in the jungles of the Far East, publishing the results of my first studies in 1895.[1] The data then published seemed to me insufficient, so after my return to England I made elaborate measurements of the anthropoid skulls in the museums of London, and the data I am to use now were compiled then.[2] Let me deal first with the largest-brained of living anthropoids—the gorilla. Making no distinction as regards sex, I found the average size of brain of the adult gorilla was 470 c.c. Now we have to infer the size of the gorilla's brain at birth from the size attained by the brain in gorilla babies about 3 months old—animals in which the milk incisor teeth are beginning to cut. From this source I have drawn the conclusion that at birth the average gorilla's brain measures at least 280 c.c.: at birth it thus approaches the human size. There is much

[1] *Journal of Anatomy*, 1895, vol. 29, p. 282.

[2] The numbers included were the following: gorilla skulls 69, chimpanzee 75, orang 297, siamang 14, gibbon 31. About one-third were skulls of immature animals.

individual variation, so that there must be an overlap of the human and anthropoid ranges, the big-brained gorilla babies exceeding the smallest-brained human babies. The real difference between the gorilla and man as regards size of brain appears after birth. During the eruption of the gorilla's milk teeth—which operation covers a period of not more than 15 months—from the 3rd month till the 18th—the brain adds only 100 c.c. to its original size, thus becoming 380 c.c. in volume. In a corresponding phase—which covers a period of 24 months—the human brain adds 820 c.c.—eight times as much as in the gorilla (fig. 11). When we trace the mean growth of the gorilla's brain—irrespective of sex—until the first permanent molars are cut, which happens, I believe, early in the 5th year, we find the brain has increased only to 390 c.c.—an increase of merely 10 c.c. —about a third of an ounce. As will be seen from fig. 11, a human brain in the same phase of growth has added not 10 c.c. but over 100 c.c. Then passing to the stage at which the second permanent molars appear, which I take to be about the 10th or 11th year, the brain of the gorilla—in the mean—has attained a volume of 458 c.c. During the period which elapses between the cutting of the first and second molars—a period of 6 years—the gorilla's brain adds 68 c.c.—about 10 c.c. per annum, a rate which is about half that observed in the human brain at a corresponding period of life. The adult size—reached about the 14th year, is 470 c.c. Thus the essential difference between the gorilla and man—so far as concerns mass of brain—is the remarkable spurt of growth in the human brain during infancy; it almost trebles its size during the eruption of the milk teeth. In the gorilla there is also a spurt during the 1st year, but it is one which adds less than a third to the mass of the brain at birth. After the initial spurt of growth in infancy there follows in both man and gorilla a more or less uniform increase until the adult size is attained. We have to distinguish these two stages—a stage of rapid growth and a stage of slow growth.

How, then, does the brain of the young Australopithecus fit into the scheme of gorilla growth as represented in fig. 11? Not very well; Professor Dart has claimed, on reasonable grounds, that the brain of Australo-

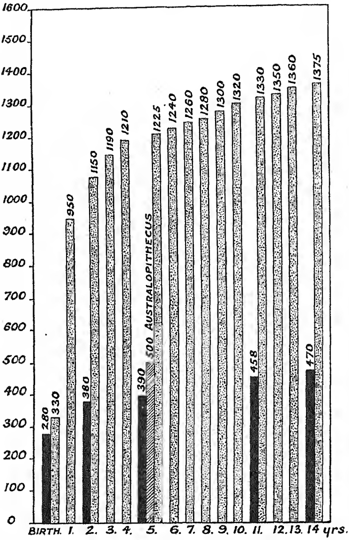


FIG. 11.—Stages in the growth of the gorilla's brain represented by black columns, set beside corresponding phases in the growth of the human brain, represented by stippled columns.

pithecus possesses certain humanoid features. The brain volume of the Taungs specimen is about 500 c.c.; at the same stage of life the mean measurement of the gorilla's brain is only 390 c.c. It is quite true that gorillas at this, as at every stage of life, show a remarkable degree of individual variation; amongst 19 gorillas, in the same

stage of dentition as the Taungs ape, the brain volume varied from 320 to 580 c.c.; many young gorillas exceed the Taungs ape in volume of brain. We must, however, take into account that the Taungs ape is almost certainly female; in all the higher primates—man and ape—the female brain, in the mean, is 8 per cent. or even 18 per cent. less than the male. In the group of gorillas measured by me the mean volume of the adult male brain was 518 c.c., of the female 427 c.c. Recently Dr. N. Dyce Sharp sent me a collection of gorilla skulls (23 male, 24 female) gathered in the same district of the British Cameroons; the brain volumes of the adult males varied from 355 to 620 c.c.—the mean being 503; the adult females ran from 370 to 530 c.c.—the mean being 426 c.c. On the other hand, higher means have been found by various observers. Dr. H. A. Harris found the mean for male gorilla skulls to be 512 c.c., the female 442 c.c.; Dr. Hagedoorn gives still higher means—550 c.c. for the male, and 478 c.c. for the female. One male measured by the latter had a capacity of 655 c.c. Thus although the cranial volume of the Taungs ape comes within gorilla limits, yet it is altogether exceptional to find a female gorilla of a corresponding age with so great a capacity. We may expect, from what we know of the brain growth of gorillas, that the Taungs brain, in its adult stage, would have added 20 per cent. more and attained a volume of 600 c.c. If the animal is a male, the addition would be more; if it proves to be a female, the addition would be less.[1] The anthropoid brain is highly variable, yet if we accept the example found in the quarry at Buxton as representative of the average female, then we must regard Australopithecus as the largest brained of all known kinds of anthropoid apes.

As the Taungs skull resembles that of the young chimpanzee in so many features, we must ascertain how the fossil ape compares with the living chimpanzee in brain development. We have seen that the brain of

[1] Professor Dart has estimated that the brain volume of Australopithecus in its adult state varied between 500 c.c. and 780 c.c.

Australopithecus was as large, perhaps larger than that of the gorilla. From fig. 12 the reader will see how much the average chimpanzee falls short of the average gorilla at various stages of growth, and therefore also of Australopithecus. At birth, the chimpanzee brain [1] has a capacity of about 240 c.c.—40 c.c. less than in the gorilla and 90 c.c. less than in the human baby. By the time the milk teeth have come into use, which I infer to be about the 15th month, the chimpanzee's brain measures about 320 c.c.—having added some 80 c.c.—an increase of a

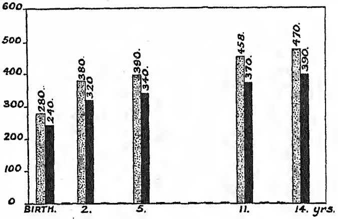


FIG. 12.—A diagram to show the size of the chimpanzee's brain at successive stages of growth (black columns). These stages are placed side by side with columns (stippled) which depict corresponding stages in the growth of the gorilla's brain. The diagram is based on measurements made on the skulls of both sexes.

third—almost the same as in the gorilla, and in sharp contrast to the human infant which—by the end of the milk dentition—has added 820 c.c.—almost trebling its size. My diagram (fig. 12) is based on measurements of skulls of both sexes. Similar inquiries have been made by Selenka [2] and by Zuckerman; Selenka's estimate for

[1] So far as I know in only one instance has the brain of the chimpanzee been weighed at birth. The chimpanzee so measured was born in captivity (recorded by Dr. Montedon, see reference p. 56); the brain in this case was weighed and described by Mlle. Coupin (*Bull. Soc. d'Anthrop., Paris*, 1925, vol. 16, p. 20), who found it to weigh only 100 grammes; which corresponds to a cranial capacity of about the same amount. One must presume that in this case the birth was premature, corresponding to a 7th month birth.

[2] Dr. Zuckerman's estimates, which were made with great care on 112 chimpanzee skulls—40 of which were immature—are the following: at the end of milk dentition (both sexes included) 314 c.c.; when first molars are cut 356 c.c.;

brain size at the end of the milk dentition is 336 c.c.; Zuckerman's 314 c.c. After the rapid increase during milk dentition the rate of growth slows down; when the first permanent molars come into place—in the 5th year (Keith), in the 7th year (Zuckerman)—the brain volume is only 340 c.c., an increase of 20 c.c. in a period of three or perhaps five years. By the time the second molars come into place, which happens, I infer, about the 11th year, the brain volume has increased to 370 c.c.—an increase of 30 c.c. in about six years. Thereafter follows a slow increase until the permanent dentition is completed—about the 14th year—when the average chimpanzee has a brain which measures 390 c.c.

Thus the youthful Australopithecus had a brain which far exceeds that of the average adult chimpanzee. Dr. Zuckerman found that at the Taungs stage of dentition the chimpanzee brain varied from 315 c.c. to 392 c.c., Selenka from 325 c.c. to 424 c.c.; in not one instance did a young chimpanzee, either male or female, attain 450 c.c., which is the minimal estimate for the Taungs ape. Indeed, the highest record for the adult male chimpanzee is 500 c.c. Thus in the matter of brain endowment Australopithecus stands far above the chimpanzee; it was the equal, if not the superior of the gorilla, but falls far short of any standard which can be regarded as human or even prehuman.

I have probably taxed the patience of my reader with details relating to the brain volume of the Taungs skull. My excuse is that brain volume, when we are dealing with the higher primates, is our best guide to mental ability. In every known instance where the human brain has fallen below the 900 c.c. level, the owner of that brain has been idiot or imbecile. In no case has the anthropoid capacity been found to rise above the 650 c.c. level. The crucial phase in human evolution was the passage from the highest anthropoid level to the lowest

up to the eruption of the second molars 357 c.c.; in adults 384 c.c. Selenka's figures are higher, viz. 336 c.c. for stage I, 360 c.c. for stage II, 382 c.c. for stage III and 405 c.c. for the final or adult stage.

human level. Now the data I have set out in the foregoing pages make one point very clear: there is a rapid increase of brain in both man and ape during infancy, the period covered by the eruption of the milk dentition, but whereas this increase adds nearly 200 per cent. to the human brain it only adds a little over 30 per cent. to the anthropoid brain. What causes the human brain to undergo this remarkable initial increase we do not know, but we are justified in drawing the conclusion that the humanity of a brain is determined during infancy and that long before the first permanent molars appear the adult size of a brain can be inferred. After the initial increase of infancy follows a steady but slow addition which is related in some undetermined manner to an increase in the size of the body rather than to an increase in mental ability. When we take all of these circumstances into consideration, it will be seen that the youthful Australopithecus—with a brain volume of 500 c.c.—does not help us to bridge the hiatus twixt the brain of ape and man. Yet it is the "brainiest" of all known anthropoid forms.[1]

Our inquiries into the characters of the Taungs skull have brought us face to face with the problems of human evolution—particularly with those related to the rise of the human brain. Before proceeding further it is essential that we look at the present state of our knowledge. In fig. 13 is set out, in a diagrammatic form, the range of volume of brain in the higher or orthograde primates, in which group are included the small anthropoids—the gibbon and siamang, the great anthropoids—the orang, chimpanzee and gorilla, and humanity—represented by races of mankind, living and extinct. At one end of this

[1] Almost the first paper I published (see reference p. 62) was to draw attention to these two phases of brain growth—the rapid initial stage of infancy and the slow, steady increase which continues during the years of body-growth. I was therefore surprised to find in Dr. Zuckerman's very excellent monograph (see reference p. 57) a sentence quoted from another paper by me in which the later growth of the brain was apparently denied. Rightly understood, the sentence thus quoted was intended to convey the opinion that not the final growth, but the important initial growth of brain was determined during infancy, while the later growth was of a different nature, being due chiefly to increase of body.

scale we have the gibbons with a mean brain volume of only 95 c.c. and a range of 60 c.c.—from 80 c.c. to 140 c.c. At the other end of the scale we have the races of mankind with a mean brain volume of 1350 c.c. and a range extending from 950 c.c. to 1950 c.c.—one of 1000 c.c. Between these two extremes—gibbons and man—the great anthropoids occupy an intermediate

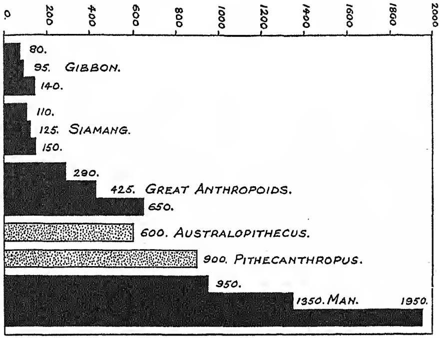


FIG. 13.—A diagram to illustrate the size of brain (cranial cavity) in the higher primates. In each case the mean size of brain is depicted by the middle column; it is set between columns which represent the largest and smallest sizes observed. The diagram is founded on the collections of specimens enumerated on p. 67.

position; if we group the orang, chimpanzee and gorilla together, we have a mean brain volume of about 425 c.c. with a range of 360 c.c.—running from a minimum of 290 c.c. in the orang to a maximum of 650 c.c. in the gorilla. In this series, which carries us from the smallest to the largest brained of the orthograde primates—from a mean of 95 c.c. to one of 1350 c.c.—there are two gaps or blanks. The first occurs between the lesser anthropoids and the greater; the siamang carries the small-brained group towards those of the medium brained; when we

know the earlier miocene forms of Dryopithecus better, we shall have all the missing intermediate stages between the small and medium brained apes. The discovery of Pithecanthropus and of Sinanthropus have helped to bridge the gulf in brain size between anthropoid and man—between the medium-brained group and the large-brained. The brain volume of Pithecanthropus may be placed at 900 c.c.—just below the lowest known human limit. The discovery at Taungs helps to carry the anthropoid series a little higher, for we have grounds for presuming that the brain endowment of Australopithecus was an advance upon that of the gorilla. The greatest blank in the series now lies between two extinct forms—Australopithecus which occupies a place at the upper end of the anthropoid series and Pithecanthropus—the man of Java—who stands at the lower end of the human series.

In fig. 13 two other matters are brought out which are worthy of attention. The first is the instability of the size of the brain in higher primates; amongst gibbons it may be as low as 80 c.c. or as high as 140 c.c.—a range of 60 c.c., representing over 60 per cent. of the mean size; amongst gorillas the brain may be as low as 370 c.c. or as high as 650 c.c.—a range of 280 c.c.—representing almost 60 per cent. of the mean size; in man it may be 950 c.c. or 1950 c.c.—a range of 1000 c.c.—representing over 70 per cent. of the mean volume. As regards size, the brain in the higher primates is unstable and therefore, we may presume, capable of undergoing an evolutionary increase. The second point to which I would draw attention is that the range above the mean is always greater than that below it. For instance, in man the range above the mean is 600 c.c., below it is 400 c.c.; amongst gorillas the largest is 180 c.c. above the mean, the smallest 100 c.c. below it. Amongst gibbons the range above is 45 c.c., that below the mean is 15 c.c. In all primates there is a tendency to produce individuals with brains of exceptional size. Further, the growth process which gives rise to these exceptional brains has its incidence in

early infancy. If we knew the circumstances which give rise to these great individual fluctuations, we should be on the road to discovering how man came by his big brain. Whatever may be the conditions or influences which give rise to exceptionally large brains, whether in ape or in man, I feel certain that "use" is not one of them; everything we know forbids the inference that the infant of ape or of man is large brained because it comes of a lineage that applied its abilities to the utmost. Big brains, whatever may be their functional worth, come irrespective of effort on the part of parent or child.

CHAPTER IV

THE BRAIN OF AUSTRALOPITHECUS

WHEN an anatomist is fortunate enough to recover the greater part of a fossil skull, almost the first thing he seeks to do is to obtain a cast of its interior. Such a cast conveys not only the general shape and dimensions of the brain which filled the skull but also much of its convolutionary pattern. Convolutionary pattern gives us a clue to the kind of animal we have discovered; from the pattern we can determine the mental status of types known only from fossil remains. The pattern will tell us whether the brain we have to deal with is in an anthropoid, in a human or in a transitional stage. Now in the case of the Taungs skull it was not necessary for Professor Dart to make a cast of its interior; Nature had made it for him. As the skull became embedded in the rock, stalagmitic deposit collected within it, filling rather more than its right half. In this way was preserved not only the dimensions and the exact shape of its interior, but also impressions of certain of the convolutions of the brain. Thus does Nature, working in a haphazard way, preserve records of her past handiwork. This unique endocranial cast was a rare gift to the discoverer, and Professor Dart seized it with both hands.

To understand the peculiar shape of the Taungs brain it is best to look first at an occipital view—the view presented by our friends when we examine their heads from behind. The vertical line (O) ascends exactly in the middle line of the skull and of the brain. Apparently before the cast was formed, the left or uppermost side of the skull had been broken or distorted; we can account for the inequalities of the left side (X, Y) only by making such a supposition.

How much the Taungs brain differed from that of the gorilla—and also of the chimpanzee—will be seen from fig. 15. There the Taungs specimen is superimposed on a corresponding view of an endocranial cast

taken from the skull of a young male gorilla, one with a capacity of 590 c.c.—90 c.c. greater than was the case in the Taungs skull. We see at once that whereas the brain of the gorilla is flattened from above downwards—thus becoming remarkably wide in comparison with its height, that of the Taungs ape was compressed from side to side, width being sacrificed to height. The greatest width of the Taungs brain we infer, from the preserved

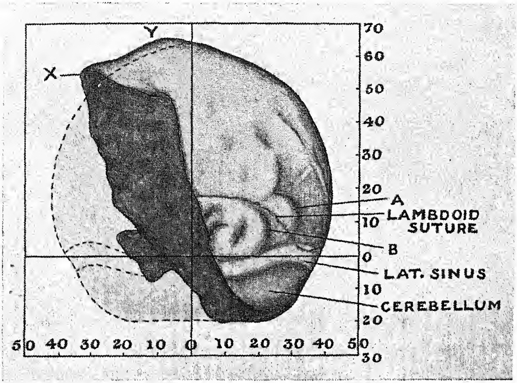


FIG. 14.—An occipital view of the Taungs endocranial cast—the skull being set on the subcerebral plane. A, Crescentic sulcus. B, Lunate (simian) sulcus (?) (X and Y, see text) (two-thirds natural size).

half, to have been 84 mm.; that of the young adult male gorilla here represented is 100 mm. The total height of the gorilla's brain, as shown in fig. 15 is 80 mm., 55 mm. being above and 25 mm. below the lateral sinus. The part above represents cerebrum; that below, cerebellum. In the case of the Taungs specimen the total height is 83 mm., 63 of this being cerebral and 20 cerebellar. We see, then, that as compared to a selected specimen of gorilla, the Taungs brain differed in two

ways; the height and width of the Taungs brain are nearly the same, whereas in the gorilla the width is 20 mm. more than the height. Further, we see that it is particularly in the cerebral height that the Taungs brain exceeds that of the gorilla. It is his cerebrum, not his cerebellum, which gives man his mental powers.

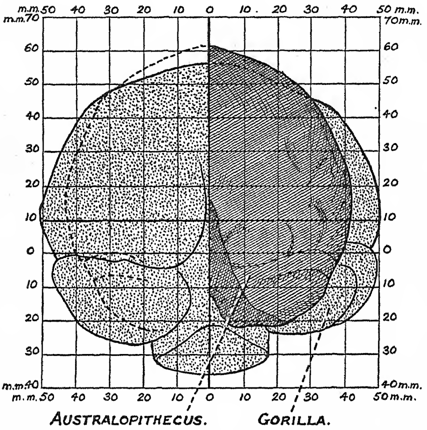


FIG. 15.—The right half of the Taungs endocranial cast superimposed on an occipital view of a corresponding cast taken from the skull of a gorilla, one with a capacity of 590 c.c. Both specimens were drawn on the subcerebral plane (two-thirds natural size).

Now a brain compressed from side to side—with a height as great as its width—we are familiar with in many living races of mankind, both high races and low. The Australian aborigines have brains shaped in this laterally compressed style, but this form is not known to occur amongst anthropoid apes except at a foetal stage of development. This observation brings us back to an inference already drawn (p. 59) that the most remarkable

features of Australopithecus represent a retention of young or infantile characters. A most striking manifestation of this tendency is shown in fig. 15. It will be seen that the cerebellar part of the gorilla cast is very much wider than that of the Taungs anthropoid; the contrasted measurements are 96 mm. and 74 mm. Now we know that the cerebellar part of the skull is narrow in youth but widens as adult years are reached—particularly in males—in all races of mankind. Women tend to retain a youthful cerebellar width. Even when we make allowances for the youthfulness of the Taungs ape, its small cerebellum (as compared to the cerebrum) and the extreme narrowness of the base of its skull are very remarkable characters. Certainly they must be taken into account when we assess the degree of humanity which is to be attributed to Australopithecus.

We must now turn to another aspect of the Taungs brain, that seen in profile. I have reproduced in fig. 16 a drawing borrowed from *Antiquity of Man*, vol. ii,[1] because it will serve to give the reader a standard for comparison. The gorilla brain cast, which is viewed from behind in fig. 15, is here shown in profile and set against a human brain cast—that taken from the Gibraltar skull. The Gibraltar skull has rather a small capacity, only 1200 c.c.—but the reader will see how greatly it exceeds the gorilla cast in every direction. Now the Gibraltar skull represents the extinct Neanderthal species of mankind; in that species the brain—particularly in its hinder part—was flattened from above, exactly as in the gorilla and chimpanzee. Thus the bun-shaped brain is not confined to anthropoids; it occurs in certain forms of mankind. The discovery of the Taungs skull proves that laterally compressed brain is not confined to humanity; it may occur in anthropoids.

In fig. 17 the same gorilla cast is represented in profile and set within a standard frame of lines 125 mm. long and 60 mm. high—large enough to take the average gorilla brain when oriented on the subcerebral plane. The

[1] Fig. 219, p. 612.

gorilla brain thus depicted is longer than usual—namely 125 mm.—but that is far short of the common human cerebral length—170 mm. The length may be as much as 180 mm., as represented in fig. 17. In height the gorilla brain reaches the 60-mm. level but falls far short of a human level, placed at 90 mm. in fig. 17. When the Taungs

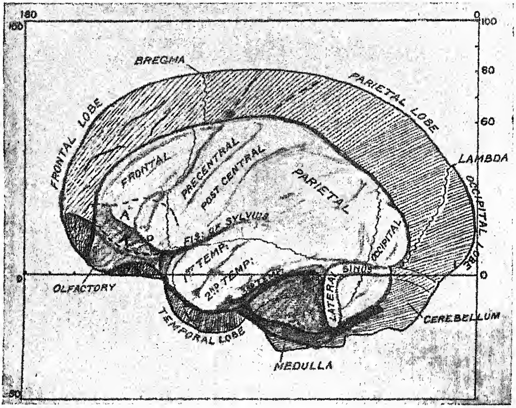


FIG. 16.—Profile of the endocranial cast of a gorilla, set against the corresponding parts of a cast taken from the interior of the Gibraltar skull. The comparison shows how much the human brain exceeds that of the gorilla in all dimensions. The specimens are set on the subcerebral plane (see p. 542, vol. ii of *Antiquity of Man*).

cast is superimposed on corresponding points of the gorilla cast, it is seen to fall short, at the frontal as well as at the occipital pole. The brain of this young adult gorilla is 125 mm. long; that of the youthful Taungs ape 115 mm. In height, as represented on the subcerebral plane, they are almost the same, 60 mm. In the hinder parietal region, however, the Taungs brain remains full and elevated while the gorilla brain in this region becomes flattened or

hollow. The fullness of the parietal region is a characteristic feature of the Taungs brain.

For over 80 years anthropologists have contrasted the width and length of a skull as a means of distinguishing one race of mankind from another. If a skull has a width which is 75 per cent. or under 75 per cent. of its length, it is said to be a long or dolichocephalic skull. If the width is 80 per cent. or over, it is said to be round—or

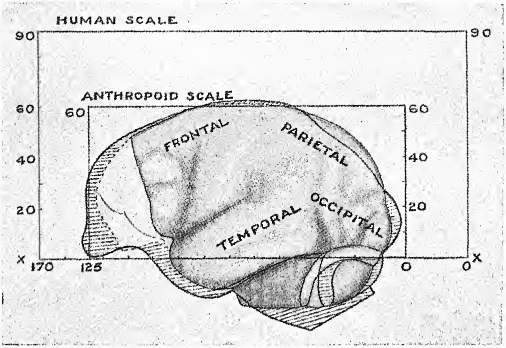


Fig. 17.—Profile of Taungs brain cast compared with that of a gorilla. Both are set on the subcerebral plane. Further explanation is given in the text (half natural size).

brachycephalic; if over 75 or under 80 it is called mesocephalic or intermediate. We may use the length and breadth of the brain or of the brain-chamber in the same way. Now, until the discovery of the Taungs skull, it was believed that endocranially all anthropoids were round or brachycephalic. For example, in the gorilla cast shown in fig. 17 the length is 125 mm.; the greatest width 100 mm.; the width is thus 80 per cent. of the length—the skull being in the lowest stage of brachycephaly. The length of the Taungs cast is 115 mm., its width 84 mm.;

the width is 73 per cent. of the length; endocranially the Taungs ape was dolichocephalic. It is so because it had a narrow brain, whereas the gorilla has a wide brain. Soon after Professor Dart published his account of the discovery at Taungs, Professor Bolk [1] and Professor Wingate Todd [1] independently drew attention to the fact that dolichocephaly does occur amongst gorillas. In a series of 34 gorilla skulls, Dr. H. A. Harris found 7 which fell into the category of dolichocephaly. In the accompanying table I give the distribution of endocranial form amongst the 47 gorilla skulls which Dr. N. Dyce Sharp collected

TABLE.

Distribution of Shape of Brain Amongst Gorillas and Chimpanzees.

	A	B	C	D	E	Mean	Max.	Min.	Range
Gorillas.						Units	Units	Units	Units
23 males	5	10	6	2	—	78·8	88·1	72	16
24 females	2	13	7	2	—	81·3	87	72·4	14·6
Chimpanzees.									
10 males	—	1	5	3	1	84·5	90·1	79·6	10·5
9 females	—	1	5	2	1	84·1	91·8	78·9	13·0

A. Those in which width of brain-chamber was 75 per cent. of the length or less.
B. Those which were over 75 per cent. but under 80 per cent.
C. Those which were over 80 per cent. but under 85 per cent.
D. Those which were over 85 per cent. but under 90 per cent.
E. Those which were 90 per cent. or over.

in the same district of the British Cameroons. I found that the width index varied from 72 to 88, the mean for males being 78·8 and for females 81·3. Amongst 19 chimpanzee skulls, also from the same district, the index ran from 79 to 92, the mean for males being 84·5, for females 84·1. Thus in brain form the Taungs ape differed altogether from the extreme brachycephaly of the chimpanzee, but it fell within the great range of brain width manifested by the gorilla. Notwithstanding this degree of resemblance to the gorilla, Australopithecus differed from that anthropoid and still more from the

[1] For references on this matter, see an article by the author on the variations of brain form in *Nature*, 1927, vol. 120, p. 914.

chimpanzee in having a brain which was compressed from side to side and was high in proportion to its length and particularly in proportion to its width.

Far be it from me to decry the value of indices—the comparison of one measurement with another, such as width to breadth of skull—but when we come to fix the status of an animal, be it anthropoid or man, absolute dimensions are always of greater importance than relative measurements. How do the brain measurements of the youthful Australopithecus compare with those of the chimpanzee and gorilla? The Taungs brain was about 115 mm. long; in the Dyce Sharp collection of gorillas the length amongst adult males varied from 111 to 128 mm., the mean being 121·6 mm.; amongst females, from 103 to 122 mm. the mean being 112·2 mm. In length the Taungs brain falls within the dimensions of male gorillas, but considering its youth is well above the female range. Amongst a similar collection of chimpanzees, the length, amongst males, varied from 98 to 108 mm.—the mean being 105·7 mm.; amongst females the range was from 98 to 114 mm., the mean being 105·5 mm. In length the Taungs brain is well above the chimpanzee range. Coming to width of brain, that of the Taungs ape is 84 mm.; in male gorillas the width ranges from 89 to 104 mm.; the mean being 95·8 mm.; in female gorillas we find the width as low as 85 and as high as 100, with a mean of 91·3. Amongst male chimpanzees the range of width is 86 to 92 mm., with a mean at 89·3; amongst female chimpanzees the width varies from 86 to 93 with a mean at 88·8 mm. Thus in width the brain of the adult Taungs ape would reach or even exceed that of the chimpanzee, but would fall far short of the gorilla width. As regards height of the brain, that of the Taungs ape is not absolutely, only relatively, high. The highest point rises 60 mm. above the subcerebral plane, a height which the gorilla's brain often attains, while that of the chimpanzee falls short of it. This matter will come up again for discussion in connection with the skull. Thus in shape and dimensions the brain of the

Taungs individual had striking characteristics, yet not any of them are of a kind which moves us to separate it from other African anthropoids, the chimpanzee and gorilla. In absolute dimensions the Taungs brain falls far below minimal human measurements.

We have been considering the size and shape of the

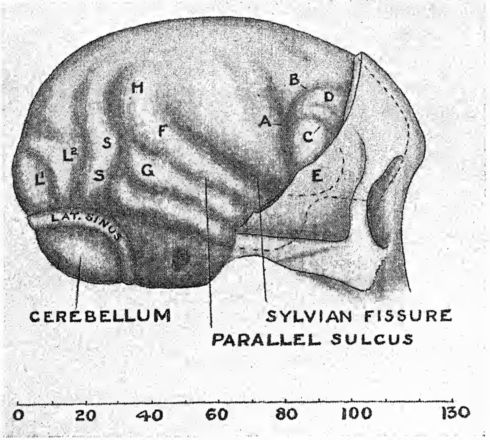


FIG. 18.—The endocranial cast of the Taungs skull with the recognizable convolutions and fissures indicated somewhat diagrammatically. To be compared with fig. 19. For explanation of letters, see text (two-thirds natural size).

brain of Australopithecus; both are anthropoid in scale. We are now to fill in certain details which throw an intimate light on the nature of that brain. When a proper illumination is thrown on a cast of the Taungs skull so as to bring out endocranial elevations and hollows, it is seen that convolutionary impressions have been preserved in three important areas (fig. 18): (1) in the frontal area—uncovered by the removal of part of

the frontal bone (A, B, C, D); (2) above the ear, in the temporal region (F, G); (3) in the occipital area (L^1, L^2). In man's brain we know that these corresponding areas are connected more or less directly with certain functions —the frontal with speech, the temporal with hearing and the occipital with sight. The question we have to answer is this: Do these impressions seen on the Taungs endo-

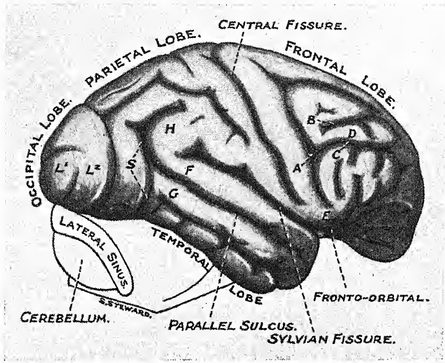


FIG. 19.—Endocranial cast of a chimpanzee on which are indicated the chief convolutions and fissures of the anthropoid brain (two-thirds natural size).

cranial cast represent a true anthropoid state or do they indicate an advance towards a condition found in human brains? My answer is that the indications are truly anthropoid and yet there are suggestions, as Professor Dart maintains, that in its convolutionary organization the brain of Australopithecus rose above that of either the gorilla or chimpanzee.

Let us turn first to the interpretation of the convolutions and fissures on the frontal area of the Taungs endocranial cast. The convolutions marked by C, D (fig. 18) are uncommonly well defined on the Taungs

cast; so are the depressions or fissures indicated by A, B and one between C and D. Now when we examine the corresponding areas of the brain of a chimpanzee or gorilla (fig. 19) we are in no doubt as to the identification of these markings. The depression or fissure which is indicated in fig. 18 by A is the lower part of the precentral fissure. In the anthropoid brain (fig. 19) this fissure is seen to descend and end on a knuckle-like projection of the frontal lobe, often spoken of as the "orbital cap" (fig. 19, E). Now this "orbital cap" is of particular importance to students of man's evolution; in the human brain the "cap" undergoes an enormous expansion and becomes concerned in speech.[1] The "cap" in the brain of Australopithecus is partly visible; it is more prominent than in most chimpanzees—but not more so than in many gorillas. Indeed, if we measure the width of the frontal lobe of the gorilla's brain—from one orbital cap to the other—we find the width—in the particular cast I have before me—is 86 mm., whereas the corresponding measurement in the Taungs brain is 75 mm. So far as concerns this part of the frontal lobe of the Taungs brain, the condition is purely anthropoid, and correspond to that frequently found in the brain of the gorilla.

Although the frontal convolutions of the Taungs brain (marked C, D, fig. 18) are prominent and of ample volume, yet their arrangement is primitive rather than highly evolved. This is seen particularly in the direct connection which the depression marked B in fig. 18 makes with the depression marked A. From this I infer that there was in the Taungs brain a reproduction of the *arcuate fissure*—a characteristic of the frontal lobe of the monkey's brain. It is usual for the A and B elements to be separated in the chimpanzee and gorilla brain (fig. 19), A forming part of the precentral fissure and B part of the upper frontal sulcus. Thus so far as concerns the recognizable markings of the Taungs brain we conclude that in form and in development they were of

[1] For fuller discussion of the orbital or frontal cap, see p. 477.

an anthropoid character and in nowise lifted that fossil form above the condition seen in gorillas and chimpanzees with well-developed brains. When we come to deal with certain recent discoveries of fossil man, we shall have to discuss the corresponding markings of the human brain.[1] Meanwhile it is well to remember that the markings of the anthropoid brain are just as variable as the features of the anthropoid face; no two animals are exactly alike in their convolutionary pattern any more than in the proportion of their facial features; each has its distinct individuality. Yet the variations lie within a definite range.

Anatomists divide the lateral aspect of the brain into four large areas or lobes—the frontal, parietal, occipital and temporal (see fig. 19). The frontal lobe we have already discussed; it is separated from the parietal by the central fissure (fig. 19), but in the Taungs cast neither this fissure nor the important convolutions which bound it can be recognized—as is nearly always the case in endocranial casts, whether they be taken from human or from anthropoid skulls. On the other hand, many features of the temporal lobe can be recognized in the Taungs cast. The Sylvian fissure which separates the temporal from the frontal and parietal lobes is indicated faintly by a slight depression, but as Professor Dart has pointed out, the parallel sulcus, which separates the upper from the middle temporal convolution, can be recognized with certainty, particularly where it lies between two convolutionary elevations (fig. 18, F, G). The parallel sulcus of the chimpanzee's brain is shown in fig. 19; when traced backwards, it is seen to ascend and terminate in the parietal lobe. Professor Dart has traced the parallel sulcus to a similar termination in the original Taungs specimen (fig. 20). Further, it will be seen that in the anthropoid brain (fig. 19) a vertical sulcus (S) emerges from the parallel fissure and descends to the lower border of the brain near the temporo-occipital junction. Apparently this S sulcus was well developed in the Taungs

[1] See p. 477.

brain for the endocranial cast shows a vertical depression in the position which such a sulcus should occupy. In size and in the complexity of its markings the temporal lobe of the Taungs ape was anthropoid; I can see no feature which distinguishes this lobe from that of the brain of a chimpanzee or of a gorilla.

The cortex of the occipital lobe is concerned with sight; in the brain of the chimpanzee, and to a lesser degree in the brain of the gorilla, the visual cortex is bounded in front by a deep crescentic sulcus (fig. 19, L^2) which Elliot-Smith named the lunate sulcus. In the human brain, when the lunate sulcus is recognizable, it is always placed far back on the occipital lobe, whereas in the anthropoid brain it occupies a forward position (fig. 19, L^2). Now Professor Dart believes that the lunate sulcus of Australopithecus is in the human position. There is a slight crescentic depression at the site indicated by him (fig. 18, L^1, see fig. 20). If Professor Dart is right, then the brain of Australopithecus had undergone a very important movement towards a human status. The nature of this evolutionary movement will be realized if the condition in the anthropoid brain is noted (fig. 19). Between the lunate sulcus (L^2) which bounds the visual area of the cortex and the upturned end of the parallel sulcus, there is in the anthropoid brain only a narrow zone. In the human brain this zone has become so greatly expanded and crumpled that its anterior and posterior bounding sulci have been pushed far apart. The area thus expanded in the human brain serves higher functions. Lying between primary areas concerned with the senses of sight, hearing and feeling, it serves to analyse and combine the impressions received by the primary centres. If Professor Dart has rightly identified the sulci which bound this area in the Taungs brain cast then we must attribute to Australopithecus much higher mental powers than are possessed by the chimpanzee and gorilla. A study of endocranial casts taken from the skulls of gorillas and a comparison of these with the Taungs cast has led me to doubt if the depression L^1 in fig. 18

is the lunate sulcus; it seems more probable that a series of slight depressions recognizable at the site marked L² in fig. 18 indicates the position of this limiting sulcus. If my interpretation is right, then this area of the Taungs brain, like the other lobar areas already dealt with, falls into the anthropoid category. We have to remember, too,

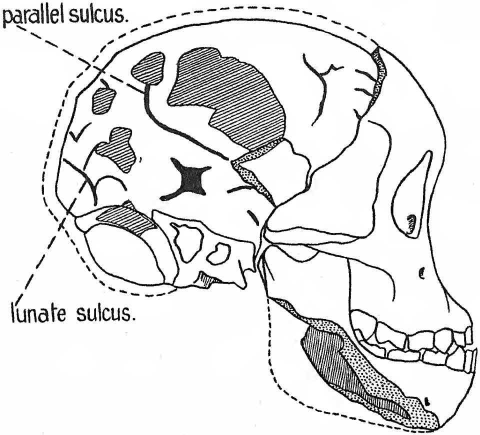


FIG. 20.—The position of the parallel and lunate sulci as identified on the original Taungs skull by Professor Dart.

that the total area of cortex on the brain of Australopithecus was not more than that of a gorilla's brain of a corresponding size and that if there had been a great expansion of one area it must have been accompanied by a corresponding reduction in some other area. There is no evidence of such a reduction.

I have entered into a somewhat full analysis of the endocranial characters of the Taungs skull; it is only by making such an analysis that we can form an opinion as

to the mental status of Australopithecus. If we find that its brain in its main characters resembles those of the gorilla and chimpanzee, we may infer that it also resembled these living forms in its habits and faculties. The volume of the brain renders it probable that Australopithecus was somewhat more endowed in this respect than the largest brained of living anthropoids—the gorilla. In shape the brain had a compressed form possessed by certain races of mankind, but such a shape is not distinctive of humanity; certain extinct races had the bun-shaped brain of the gorilla and chimpanzee. Further, although such convolutions and fissures as can be identified with certainty on the Taungs endocranial cast equal, if they do not exceed, the corresponding parts in the better-developed brains of gorillas, yet the difference is not such as to lead us to separate Australopithecus from the category of anthropoid apes and place it in a separate group—one intermediate to the highest ape and lowest form of humanity.

CHAPTER V

THE IMPORTANCE OF THE DISCOVERY AT TAUNGS. FURTHER DETAILS CONCERNING THE NATURE OF AUSTRALOPITHECUS

THE reader will see from the space I am devoting to it that I count the discovery at Taungs as one of high importance. My reasons are these: In all former discoveries of fossil remains there has rarely been any doubt as to their humanity. The problems which had to be solved in their case related to the type of man represented by the fossil bones and the relationship of the type to past and present races of mankind. There was, however, one exception—the discovery of Pithecanthropus made by Dr. Eugene Dubois at Trinil in Java between 1891 and 1894.[1] The fossil remains brought to light puzzled anatomists by their apparent incongruity. The thigh bone and teeth were human, while the skull-cap appeared to be simian. The final humanity of Pithecanthropus was established by the brain cast taken from the skull; its convolutionary pattern is human, not anthropoid. The brain of Pithecanthropus was very different from that of Australopithecus; it was bun-shaped and measured about 900 c.c., placing its owner on the threshold of humanity. In its importance the discovery announced by Professor Dart is the counterpart of that made by Dr. Dubois. In each case the discoverer had to deal with a mixture of parts; the one was confronted with a fossil type which was mainly humanoid; the other with one which was distinctly anthropoid. The discovery at Trinil raised the question: What is a man? That at Taungs: What is an ape? In its shape and in the proportion of cerebellum to cerebrum the brain of Australopithecus may be regarded as humanoid, but in volume and in convolutionary pattern it is definitely anthropoid. The brain is anthropoid, but are the other parts of the skull of this nature? This is the question we have now to

[1] See vol. ii, p. 419, of *Antiquity of Man*.

examine, and to provide an answer we must make a detailed analysis of the cranial and facial characters of Australopithecus.

In fig. 21 an exact profile of the Taungs skull is placed upon a drawing of a child's skull—that of an Australian aborigine, in whom the first permanent molar had just

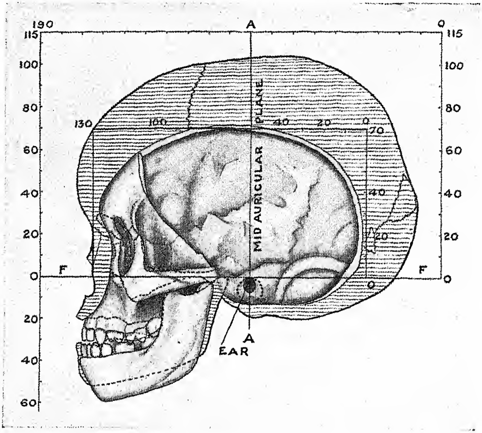


Fig. 21.—Profile of the Taungs skull superimposed on that of an Australian aborigine child. Both are at the same stage of tooth eruption. Both are oriented on the same plane (Frankfort), the ear of the one coinciding with the ear of the other.

erupted. This skull is therefore at the Taungs stage of development. The ear of the one is superimposed on the ear of the other and both are arranged on the same plane—the Frankfort plane, represented by the line F–F. This line, it will be observed, cuts the lower border of the orbit and upper border of the auditory meatus (ear). Between the ear and orbit the cerebrum descends to this level, and

thus we may regard the height to which the vault of the skull rises above the Frankfort plane as a measure of the height of the cerebrum. It will be seen that the vault of the Taungs skull rises until it passes slightly above a horizontal line which has been drawn 70 mm. above the Frankfort plane. In technical language the "auricular height" of the Taungs skull is 73 mm., allowing 3 mm. for the thickness of the missing bone of the vault. The auricular height in the Australian child's skull is 102 mm., nearly 30 mm. more, but it falls 13 mm. short of the upper horizontal, drawn 115 mm. above the Frankfort plane, which the cranial vault of a well-developed adult Australian should reach.

It is not only in height of cranial box but also in length that the Australian so greatly exceeds the Taungs skull. The length of the child's skull is 162 mm.; in the adult state it may become 190 mm. long and thus reach the two vertical lines shown in fig. 21, these being 190 mm. apart. The vertical lines set at either end of the Taungs skull are only 130 mm. apart; the skull falls short of these lines for its full length—allowing for the missing occipital bone, was not more than 128 mm., against 162 for the child's skull. The greatest width of the cranial box in the child's skull is 117 mm.—this being 72 per cent. of the length. The original width of the Taungs skull I estimate to have been 90 mm., which gives a width percentage (cephalic index) of 70. Thus in the proportion of width to length these two skulls nearly agree, but one has only to look at fig. 21 to realize how overwhelmingly greater are the absolute measurements of the child's skull and brain.

When we compare the facial parts of the two skulls represented in fig. 21 we see that the difference in size is not great. The outer wall of the orbit of the one corresponds very nearly to that of the other. The bar of bone—the zygomatic arch—which runs from the ear to the orbit and cheek bone nearly coincide, but that of Australopithecus is the stronger, from which we infer that the muscle of mastication attached to this bar was more

highly developed than in the human child. Even in the forward projection of the jaws the two are almost the same, the part of the upper jaw which carries the central incisors projecting 81 mm. in front of the mid-auricular plane (see fig. 21, A, A) in the human and 79 mm. in the Taungs skull. The length of the face, measured from the root of the nose (nasion) to the lower border of the mandible, is 75 mm. in the child's skull, 80 in the Taungs skull—no great difference.

It is when we compare their profiles in the region of the nose (fig. 21) that we observe a marked discrepancy. The nasal part of the Taungs face is concave and hollowed, whereas the nasal parts in the Australian child are carried forwards so that they are almost vertically above the front part of the jaws. The great expansion of the child's brain has pushed forward the frontal bone which has carried with it the nasal parts of the face. Thus when we measure the distance of the root of the nose (nasion) from the centre of the ear in the child's skull, we find it to be 79 mm., whereas in the Taungs skull it is 71 mm. On the other hand, if we measure the distance of the most anterior part of the upper jaw from the centre of the ear, we find the distance to be almost the same in both—80 mm. in the fossil skull, 82 mm. in the human. Such lines, drawn from the centre of the ear, the one to the nasion and the other to the alveolar point (see fig. 24), form two sides of the upper facial triangle; the base of the triangle, represented by the line which joins the nasion to the alveolar point, measures 43 mm. in the Australian child and 46 mm. in the Taungs skull. This upper facial triangle is worthy of our attention; when the upper side of the triangle—passing from ear to root of nose—preponderates, it signifies development of brain (with certain exceptions to be mentioned later). When the lower side joining ear and point of upper jaw is excessive, it indicates preponderance of jaws. In the evolution of man the upper side of this triangle kept increasing as the brain expanded, the lower side decreased as the jaws receded. The upper facial triangle in the

Taungs skull is simian rather than human in its shape and proportions.

We have seen that the Taungs skull, when compared to a child's, falls altogether short of a human standard in development of brain, but in development of face the differences are not so great, if we except the region of the nose. We must now compare the Taungs with anthropoid skulls, selecting that of the chimpanzee in the first place, as there are so many points in which the Taungs skull resembles that of the chimpanzee. The example I have selected is at a somewhat younger stage than the Taungs specimen, the first permanent molar being only on the point of eruption. It is also a rather small (female) example, its length being only 98 mm., whereas chimpanzees with the first permanent molars fully erupted vary in length from 106 to 125 mm.[1]—this maximum being only 3 mm. short of the Taungs skull. In fig. 22 this young chimpanzee skull is superimposed on the Taungs skull and both are placed in the framework of lines shown in fig. 21. The vault of the chimpanzee skull fails to reach the 70 mm. horizontal by 5 mm., whereas the Taungs skull rises 3 mm. above it, but such a height is often reached, or even surpassed, in chimpanzees of Taungs age. The excess of the Taungs vault in the parietal region is very noticeable. It is chiefly in the occipital and frontal regions—particularly the latter, that the Taungs profile exceeds that of the chimpanzee. Indeed, the difference between the brain-containing part of these two skulls, although much less in amount, is of the same kind as that seen in fig. 21, where the Taungs skull is contrasted with a human child. On the other hand, we have to remember that the comparison in profile is unfair to the chimpanzee, as the skull shown in fig. 22 is 87 mm. in its greatest width, almost the same as the fossil skull, the width in this particular chimpanzee being 88 per cent of the length, whereas in the Taungs skull it is only 70 per cent.

We see, then, when we compare in profile the brain containing part of the Taungs skull with the same part

[1] See Zuckerman, reference, p. 56.

of a chimpanzee's skull at a younger stage of growth that the Taungs specimen exceeds the other in all parts, but more particularly in three regions—the cerebellar, the upper parietal and particularly in the frontal. The differ-

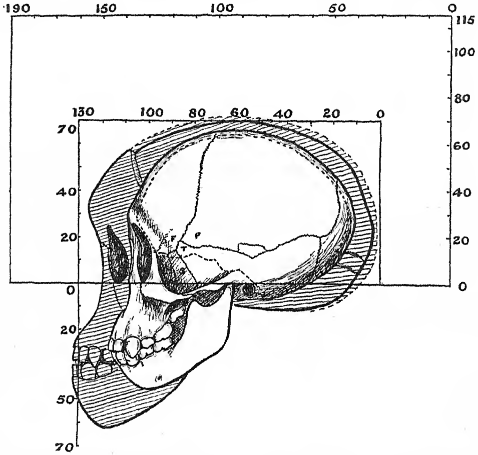


FIG. 22.—A chimpanzee's skull superimposed on the Taungs skull and both placed in the framework of lines used for comparison in fig. 21. The chimpanzee skull is that of a female animal in which the first permanent molar teeth are on the point of eruption. P, parietal bone; F, frontal; T, temporal; S, sphenoid. Oriented on Frankfort plane (O,O).

ences are considerable, and yet they are due to form rather than to the capacity of the cranial cavity.

Two other remarkable features of the Taungs skull may be mentioned here. Although the chimpanzee skull is at a younger stage of growth than the Taungs, yet the bony ridges above the orbits of the former are already clearly differentiated, adding 4 mm. to the length of the skull. In the Taungs skull such ridges have not appeared; we must note, too, the glabellar elevation on the forehead

above the root of the nose (fig. 22), which is a peculiar feature. I have already mentioned the persistences of infantile traits—or delay in the assumption of adult states—as characteristic of Australopithecus. This is exemplified by its forehead. The other unexpected feature of the Taungs skull is shown by the contacts made by bones in the temporal region. In the chimpanzee's skull (fig. 22) it will be seen that the temporal bone (T) pushes forwards between the parietal (P) and sphenoid (S) to come in contact with the frontal (F), whereas in human skulls the sphenoid (S) thrusts upwards between the temporal and frontal to form a contact with the parietal. As will be seen from fig. 5 (p. 48), the arrangement in Australopithecus was human. Occasionally in human skulls the anthropoid arrangement occurs and the human may appear in anthropoids—particularly in the orang's skull, but these exceptions are rare in chimpanzee and gorilla skulls.[1] In the arrangement of bones in the region of the pterion the Taungs skull reveals a human feature and gives support to Professor Dart's contention that Australopithecus should have a place in man's ancestry.

When we come to compare the facial profiles of Australopithecus and the chimpanzee (fig. 22), we find almost an identity in shape, in spite of a difference in size. Were the face of the young chimpanzee to grow and retain the proportion of its parts, it would come to coincide with the outline of the Taungs face. In cheek, nose and jaw they are almost identical, yet there are certain significant differences which are brought out when we compare their upper facial triangles (see fig. 24). One side of this triangle is formed by a line drawn downwards on the face from root of nose (nasion) to the edge of the upper jaw (alveolar point). In the Taungs skull this line measures 46 mm.; in the chimpanzee 42—being 4 mm. less. The lower side of the triangle, from ear to alveolar point, measures 80 mm. in the fossil skull, being 62—18 mm.—less in the chimpanzee's skull. The upper

[1] The articulation of bones in the region of the pterion is again discussed in Chapter XXXII, p. 495.

side of the triangle, from ear to nasion, measures 71 mm. in the Taungs skull and only 55—16 mm. less—in the other. It will be remembered that with the evolution of man the lower side of this triangle (the ear-alveolar distance) tends to shorten owing to a reduction in size of jaws, whereas the upper side (ear-nasion distance) tends to elongate with increase of brain. Now in the Taungs, as in the chimpanzee skull, shown in fig. 22, the ear-alveolar

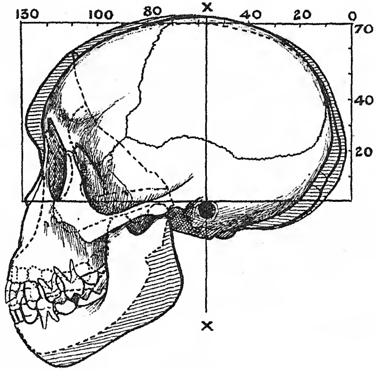


Fig. 23.—The profile of Australopithecus superimposed on that of a gorilla, in which the first permanent molars are on the point of eruption.

distance is 12 per cent. greater than the ear-nasion distance, but in the chimpanzee the face is relatively longer. The relative shortness of the face is a remarkable feature of the young Australopithecus. The form of nose and of upper jaw and the amount to which the upper jaw projects in front of the sill of the nose, are alike in both skulls. In all these respects both Australopithecus and the chimpanzee differ from any known humanoid form. It has been made clear by this process of analysis that the differences between

Australopithecus and the chimpanzee are slight compared with those elicited in its comparison with a child's skull.

In fig. 23 the Taungs skull is superimposed on that of a gorilla in which the first permanent molar teeth are just about to cut, being thus at a slightly earlier stage of eruption than in the Taungs specimen. The total length of the gorilla's skull is 115 mm., against 128 mm. in the fossil skull, the preponderance of the latter being chiefly due to a forward projection of its frontal region. The height of the vault above the Frankfort plane is almost the same in both. But as regards width this gorilla's skull measures 96 mm., against 84 mm. in Australopithecus. The Taungs skull is the longer, but the gorilla's skull is the wider; in total cranial capacity there can be little difference between them.

When we compare the facial outlines of the young Australopithecus and the young gorilla, we observe a similarity of size but a difference in form, whereas in our comparison with the chimpanzee (fig. 22) we found that the difference was in size, not in form. The gorilla has the longer face, the distance from nasion to lower border of the mandible being 94 mm., whereas it is only 80 mm. in the Taungs specimen. The forward projection of the upper incisor sockets in front of the mid-auricular plane (X, X) is almost the same in both, being 77 mm. in the gorilla, 79 mm. in the Taungs specimen. They are equally prognathous. But while the degree of prognathism is almost alike, it will be seen from fig. 23 that their facial profiles differ in three important respects. (1) The forehead of Australopithecus is protuberant compared to that of the gorilla, and yet the supra-orbital ridges of the latter are already distinctly in evidence. (2) The nasal region of Australopithecus recedes, giving the face its concave outline, while the nasal region of the gorilla projects, the facial outline being nearly straight. In this respect the gorilla is the more human. (3) The lower jaw of the gorilla is the more massively developed; in depth (or height) of symphysis it measures 28 mm., against

25 mm. in the Taungs mandible. In thickness, as measured in an antero-posterior direction, the gorilla's mandible is the stronger, this measurement being 13·5 mm., whereas in the Taungs mandible the symphysis is only 11 mm. thick. Yet in their conformation and characters

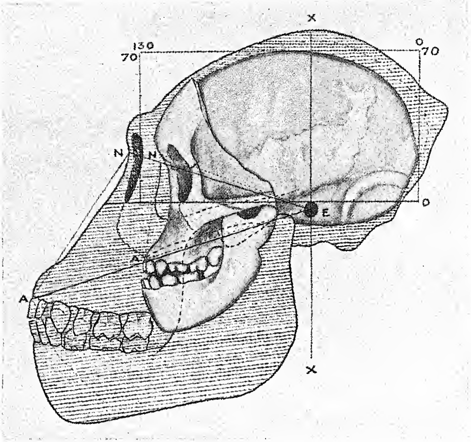


FIG. 24.—Profile of the Taungs skull superimposed upon a young gorilla's skull. The skull is that of a Kivu gorilla in which the first permanent molars were in use. It is thus in a more advanced stage of dentition than is the Taungs skull. E, ear; N, nasion; A, alveolar point. Lines joining these three points map out the upper facial triangle.

the symphyseal regions of the two show no real point of difference.

To bring out the essential characters of Australopithecus, it will repay us to compare the outline of its head with that of a gorilla in a somewhat more advanced stage of growth, as has been done in fig. 24. The gorilla selected is a young male specimen of the highland or Kivu breed. The first permanent molar teeth of this

animal are fully erupted and in use, but its other teeth are of the milk set. It will be seen that the gorilla skull exceeds the Taungs specimen in length and height; it also exceeded it in width, and yet the capacity of the gorilla skull is only 480 c.c., showing that Professor Dart's estimate of 550 c.c. for the Taungs skull is far too high. It is true that the amount to which the gorilla forehead projects in front of the Taungs forehead (fig. 24) is due to growth of bone and not brain, yet in total length of brain chamber the gorilla is the longer. As seen in profile the facial parts of the gorilla's skull are overwhelmingly the greater. There has been an enormous growth in the jaws, both upper and lower, so that the muzzle of the gorilla has been carried far in advance of that of Australopithecus. The point of the muzzle in the gorilla lies 130 mm. in front of the vertical auricular plane, while the same projection in the Taungs skull is only 79 mm.

The growth of the face alters completely the proportions of the upper facial triangle. This triangle is indicated in fig. 24 (E, N, A). The lower side of the triangle, represented by a line drawn from the centre of the ear (E) to the alveolar point (A) is an index of jaw development. In the Taungs ape it measures 80 mm., against 138 mm. in the young Kivu gorilla. The measurement of the latter is the greater by 58 mm. or 70 per cent. On the other hand, the upper side of the triangle, drawn from ear (E) to nasion (N), is an index of growth of the base of the skull. In the Taungs ape this side of the triangle measures 71 mm., in the young Kivu specimen 90 mm. —an excess of 19 mm.—representing an increase of 27 per cent. of the upper side, against a 70 per cent. increase on the lower side. This change in proportion of dimensions is all the more remarkable, seeing that at the earlier stage of gorilla development, depicted in fig. 23, the dimensions and proportions of the facial triangle are almost identical in gorilla and Australopithecus.

Before leaving our consideration of the upper facial triangle, two other points are worthy of note. The upper

side of the triangle (E, N), as has just been said, indicates the pre-auricular length of the skull base. An increase in this measurement, however, may be due to two totally different processes; it may be due to growth of brain, as it is in the young Taungs anthropoid and in higher races of mankind, or it may be due to increase of bone, as it is in the gorilla and in certain primitive forms of humanity where the forehead becomes prolonged into supra-orbital bony shelves. The other point in the facial triangle which is worthy of note relates to its anterior side, represented by a line drawn from nasion to alveolar point (fig. 24, N, A). This side—the upper facial length—is remarkably short in the Taungs skull, being only 46 mm., corresponding to dimensions found in the young chimpanzee. Even in the young gorilla shown in fig. 23 the upper facial length exceeds that of the Taungs skull by 16 mm., while in the older specimens represented in fig. 24 the excess is 36 mm. The gorilla has a long face, whereas the Taungs anthropoid resembled the chimpanzee in having a short one.

Our comparison of skull profiles has led us to a definite conclusion, viz. that the affinities of Australopithecus are to be sought for amongst anthropoid apes, not among known human or humanoid forms. We reach the same result when we compare full-face views of diverse skulls, as has been done in figs. 25, 26 and 27. In these figures the right half—the more perfect half—of the Taungs skull has been set against the left half of human, chimpanzee and gorilla skulls. The specimens selected for comparison are those already depicted in figs. 21, 22 and 23. All are presented from exactly the same point of view and are therefore directly comparable.

We have already noted the hollowing or concavity of the nasal region of the face of Australopithecus, particularly well brought out when viewed in profile (fig. 5, p. 48). We have seen the same nasal retrocession in the chimpanzee (fig. 22, p. 92) and in the orang the reduction in the nasal region is still more remarkable. In the gorilla an opposite condition holds; the nose is relatively

prominent and the face relatively straight. Indeed, it is by the nasal bones that we can most readily distinguish a gorilla from a chimpanzee—the nasal bones being long and spatulate in the gorilla, short, flat or even sunken in the chimpanzee. As is well known, the nose provides a means of distinguishing one race of mankind from

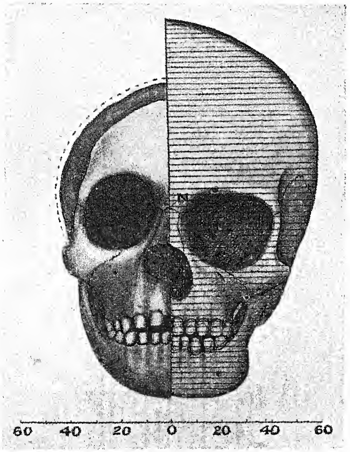


FIG. 25.—The right half of the face of the Taungs skull set beside a corresponding view of the skull of an Australian aborigine child (see fig. 21). Both skulls were drawn after being set on the Frankfort plane. The nasion of the one is set opposite the nasion of the other (half natural size).

another. There are races such as the pure negro or the typical mongol, in which the bridge of the nose is flat and low, the nasal bones being relatively small, as in the chimpanzee, while there are others, such as the semitic and allied peoples, in which the bridge of the nose is prominent and the nasal bones developed to excess. We know something of the growth mechanisms involved in

producing these contrasted features. In the disorder of growth known as acromegaly, where there is always an overaction of the pituitary gland, the nasal bones—indeed, all parts of the nose—become enlarged and prominent. On the other hand, in the disorder known as cretinism, where the thyroid gland fails in its function, the nose is always undergrown, and a condition not unlike that seen in the flat negro or mongolian nose results.

As regards all the characters of the nose, Australopithecus resembles the chimpanzee. It is not difficult to find a young chimpanzee's skull which has the nasal dimensions of the Taungs skull. The nasal height, measured from nasion to the rounded sill of the nasal aperture, is 34 mm. in the Taungs skull; its width of nasal aperture measures 17 mm. The height of the aperture is 15 mm., while its nasal bones are 17 mm. in length. All of these dimensions can be duplicated in the young chimpanzee's skull, but the nasal bones of Australopithecus are exceptionally wide for a chimpanzee and in this respect approximate to a human state. In two other respects there are suggestions of humanity. The nasal bones of the young Australopithecus are in process of union (fig. 6, p. 49); bony union of the nasal bones begins at or soon after birth in the chimpanzee and gorilla, whereas in man union occurs, if it occurs at all, late in life. In the gibbon, which resembles man in its nasal features more closely than other anthropoids, union is delayed until adolescence. The other point which may be regarded as a human character is the absence in the Taungs skull of a projection of the upper ends of the nasal bones into the mid-frontal suture. This mid-frontal projection is usually present in gorillas, often absent in chimpanzees and always lacking in man and in the gibbon. One other point remains to be noted in the Taungs nose—its narrowness at the root where it forms a partition between the one orbit and the other. The interorbital width (internal bi-angular) is only 13 mm.—a measurement common in skulls of young chimpanzees and gorillas, but never seen in children; at 6 years of age

this diameter should measure in a child from 15 to 20 mm. Thus in the characters of its nose Australopithecus is anthropoid rather than human.

There is one feature we seek for in the face of the Taungs skull with especial interest. In all anthropoid apes known to us there is to be seen on the face at each side of the nasal opening a sutural line, which descends

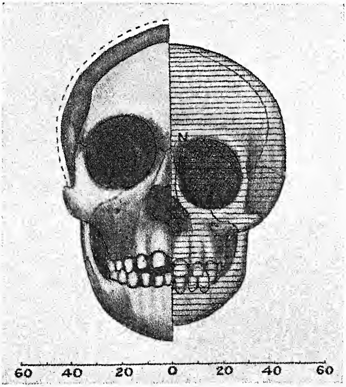


FIG. 26.—The right half of the face of the Taungs skull set side by side with the left half of the skull of a young chimpanzee, which is in a rather earlier stage of dentition. The same specimen is depicted in fig. 22. Both specimens were oriented on the Frankfort plane. Nasion is made to correspond with nasion (half natural size).

towards the gap between the canine tooth and the lateral incisor tooth. This line or suture is particularly well seen in the young gorilla (fig. 27, and also in the young chimpanzee, fig. 26). It is also quite evident in the Taungs skull (figs. 6, 26). It is never seen in a human skull at any stage of growth. And yet we know from other evidence that at one stage of his evolution man must have possessed this premaxillary sutural line. His upper jaw, like that of all primates, was made up of two parts—a pre-

maxillary part, which carried the upper incisor teeth, and a maxillary part which provides sockets for all other teeth. In the bony palate of the child the division or sutural line between the premaxilla and maxilla is still clearly demarcated, but the division is never visible on the face for the reason that as soon as the bony premaxilla begins to form

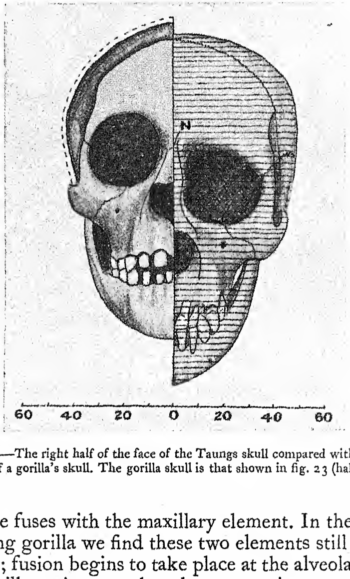


FIG. 27.—The right half of the face of the Taungs skull compared with the left half of a gorilla's skull. The gorilla skull is that shown in fig. 23 (half natural size).

it at once fuses with the maxillary element. In the skull of the young gorilla we find these two elements still separate (fig. 27); fusion begins to take place at the alveolar border as the milk canine cuts, but the process is not completed until the permanent canines erupt, and even in adult skulls we may still find traces of the premaxillary suture. This suture disappears precociously in human skulls; it is delayed until adult life in the gorilla and also in the

male orang. The chimpanzee and gibbon help to fill in the gap between these two extremes; for in them the premaxillary suture disappears as the second permanent molars erupt. The premaxillary suture in the Taungs skull is at the point of closure we expect to meet with in a chimpanzee of the same age. In premaxillary development Australopithecus was anthropoid, not human.

In shape and size the orbits of Australopithecus correspond to those of a chimpanzee at the same stage of dental eruption, but are smaller than the orbits of gorillas at a comparable age. The height of the right orbit in the Taungs cast is 27 mm., its width 28 mm.; the corresponding orbital measurements in a child of 6 years are 30 × 30 mm. In the Taungs skull, as in that of a human child (fig. 25) the supra-orbital ridges have not commenced to grow out, whereas, in the chimpanzee (fig. 26) and particularly in the gorilla (fig. 27) they are already demarcated. Herein the Taungs ape shows a feature which may be regarded as genuinely human. On the other hand, the minimal width of its forehead is anthropoid; its width I estimate to have been 64 mm., a measurement which can be paralleled in the skulls of many young chimpanzees, whereas in the young human forehead we expect a measurement of over 80 mm.

The contour of the cheek bones of Australopithecus and the shape of its upper and lower jaws are anthropoid, not human, as may be seen from the comparisons made in figs. 25, 26 and 27. It is quite true, as is pointed out in various chapters of this work, that the cheek bones and jaws of certain extinct types of mankind do copy the anthropoid type. For this reason I do not attach weight to these characters as guides to the true nature of Australopithecus. Yet our comparison of the profile and full-face of the Taungs specimen with corresponding views of human and anthropoid skulls leaves no doubt as to the true status of Australopithecus, viz. that in all its essential characters it is a true anthropoid ape.

CHAPTER VI

DENTAL AND OTHER CHARACTERS, WITH FINAL CONCLUSIONS REGARDING AUSTRALOPITHECUS

The evolution of man has been attended by changes in two parts of his body; the brain has expanded; the jaws have become reduced. These opposite processes are correlated, but not closely. We may safely say, however, that the most highly evolved races of mankind are those with the largest brains and smallest jaws. This evolutionary trend in the human stock has been discussed in several chapters[1] of *Antiquity of Man*. In these discussions the volume of the cavity of the skull—the cranial capacity—has been taken as an indication of brain development and the area of the roof of the mouth—the dental palate—has been employed as an index of jaw development. In European races, for example, a cranial capacity of 1500 c.c. is often conjoined with a palatal area of 25 cm.^{2} In such individuals there is a ratio of 1 cm.^{2} of palate to 60 c.c. of cranial capacity.

Now when we follow young primates through their periods of growth, no matter whether the subject of our study is a child or an anthropoid ape, we find that in passing from infancy to adult years, jaw development gains rapidly on brain expansion. The highest ratio of brain to palate occurs during infancy; thereafter the ratio falls rapidly. For instance, the area of the palate of a chimpanzee at the same stage of growth as the Taungs anthropoid, is about 20 cm.^{2} while the cranial capacity is 340 c.c., giving a ratio of 1 : 16, whereas in the adult chimpanzee it often falls to 1 : 8.

The cranial capacity of the Taungs anthropoid has been estimated at 500 c.c., which is well above the average chimpanzee's of the same age (340 c.c.) and even that of the gorilla (390 c.c.). How does the Taungs palatal area compare with theirs? In fig. 28 is represented the palate of a chimpanzee in which the first permanent

[1] See vol. i, chapters v and x; vol. ii, chapters xxi, xxviii and xxxiii.

molars are in place. Beside it is given a diagrammatic representation of the palate of Australopithecus. The chimpanzee palate is larger than the other; the area which lies within a line encircling the outer margins of the teeth (fig. 28), measures 20·2 cm.^{2}; the palatal area of Australopithecus I estimate at 18·6 cm.^{2}—1·6 cm. less than in an average chimpanzee of the same age. At a corresponding stage of growth the gorilla has a considerably larger palate—namely 22·3 cm.^{2}, but in a representative child the palatal area is considerably less than in Australopithecus, namely 14·3 cm.—4·3 cm. less.

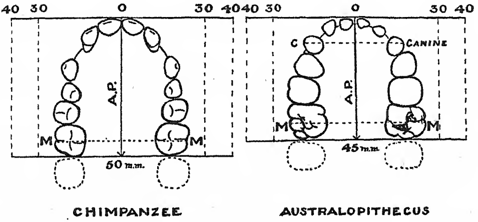


FIG. 28.—(A) The palate of a chimpanzee in which the first permanent molars have erupted, to show the measurements mentioned in the text. (B) A diagram to show the palatal dimensions of Australopithecus, compiled from Professor Dart's cast of the skull and from data supplied by Dr. Broom.

It is possible to find chimpanzees with as small a palatal area as that of the Taungs anthropoid and children with palates quite as large, but the means are approximately as stated. In size the palate of Australopithecus makes a nearer approach to the human condition than does that of either the chimpanzee or gorilla. In ratio of palatal area to cranial capacity it also is the more human. In a child of six years the palatal area (14·3 cm.^{2}) stands to the cranial capacity (1205 c.c.) as 1 : 84. The same ratio in Australopithecus is 1 : 26 (palatal area 18·6 cm.^{2}, cranial capacity 500 c.c.); in the young gorilla 1 : 17 (palatal area 23·3 cm.^{2}, cranial capacity 390 c.c.), while in the chimpanzee the ratio of palate to brain is 1 : 16.

Thus in its palato-cerebral ratio the young Taungs anthropoid is more human than either the gorilla or chimpanzee, but plainly there is a wide gap between the human ratio 1 : 84 and that of Australopithecus 1 : 26.

We obtain some further insight into the true nature of Australopithecus when we compare the chief diameters of its palate with those of children and young anthropoids. The first diameter to which I want to draw the reader's attention is the bicanine width—the width between the outer surfaces of the right and left canine teeth (fig. 28). The milk canines of Australopithecus are remarkably small and set closely together, the bicanine width being 34 mm.—the same as in an average child at a corresponding state of dentition. In the chimpanzee and gorilla the milk canines are larger and project more above the level of neighbouring teeth. The bicanine width in a chimpanzee of a corresponding age is 40 mm.; in the gorilla 42 mm. In its bicanine width and in the development of its milk canines Australopithecus is more human than either the chimpanzee or gorilla.

The next palatal diameter I wish to deal with is the bimolar width—measured between the outer or buccal surfaces of the first pair of permanent molars (fig. 28). Let us take the human palate first; the bimolar width in a representative human child is 50 mm.—16 mm. more than the bicanine width; the human palate has the form of an arch—narrow in front and wide behind. In Australopithecus the bimolar width is 48 mm.—14 mm. more than the bicanine; in the chimpanzee 48 mm.—only 8 mm. more than the bicanine width; in the gorilla, 52 mm.—10 mm. more than the bicanine diameter. In all four the bimolar width is not greatly different; the real difference lies in the bicanine width, and in this the palate of Australopithecus stands next to that of man.

When, however, we compare the third important diameter of the palate, namely its length, we find that Australopithecus slips back into the anthropoid category. The length of the palate, measured as is shown in fig. 28 (A, P), is only 35 mm. in the child, whereas in Australo-

pithecus it is 45 mm.; in the chimpanzee 49 mm. and in the young gorilla 52 mm. In proportion of length to bimolar width, Australopithecus is anthropoid, not human.

The milk teeth of Australopithecus are remarkably small, but before we consider the temporary teeth, let us see what we know of its permanent or final dentition. The first molars are in place; Dr. Robert Broom[1] has examined and measured them. His drawings show that the first upper molar is 13·0 mm. long and 13·5 mm. wide—a very large tooth. Even in the gorilla, in which molar development finds its greatest expression, the mean length of the upper first molar is only a little longer—namely 14·6 mm. In the chimpanzee the mean length is 10 mm., in man 10·7 mm., in the orang 11·7 mm. If we turn to the first molar of the lower set we find the same promise of great molar development in Australopithecus. The lower molar has a length of 14 mm. and a width of 13·5 mm.[1] In the gorilla the same tooth has a mean length of 15 mm.; in the orang 13·3 mm.; in the chimpanzee 11·5 mm.; in man 10·5 mm. The gorilla is remarkable among anthropoids for the strong and massive character of its teeth, and yet Australopithecus, in spite of its small milk teeth, gives clear indication that in its permanent dentition it will far outdo the chimpanzee and man and approximate—at least in its molar development—to the gorilla. To carry such teeth the adult Australopithecus must have been provided with massive jaws and palate of the anthropoid type. The first permanent molars throw a flood of light on the adult physiognomy of Australopithecus and proclaim its full anthropoid nature.

Professor Dart ultimately succeeded in freeing the mandible from the rest of the skull, thus exposing to full view the crowns of the upper and lower teeth. The molar teeth are remarkable in several respects. The cusps of the molar teeth, in shape and arrangement, are more human than those of the chimpanzee or gorilla; they

[1] The measurements are founded on Dr. Broom's drawings, *Nature*, 1925, vol. 115, p. 570.

make a closer approach to a human condition than has been seen in any other anthropoid, living and extinct. Another feature is the width of the molar crowns; the crowns are long; they are also relatively and absolutely very wide.

Professor Dart, in assuming the humanity of Australopithecus, rightly emphasized the smallness of its milk teeth and the vertical implantation of the incisors—

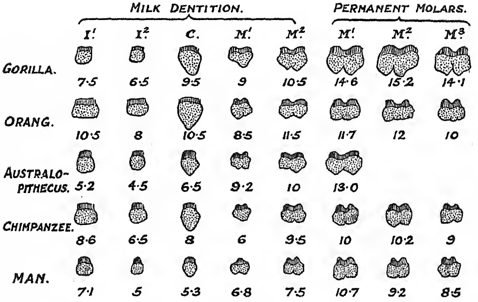


FIG. 29.—A diagrammatic representation of the upper teeth of the milk dentition and of the permanent molars in the gorilla, orang, Australopithecus, chimpanzee and man. Mean measurements of length (medio-distal diameter) are depicted below each tooth. Measurements in millimetres.

these being characters of children. The milk dentition is not a reliable indication of what the permanent teeth may be. The young gorilla has small incisor teeth—smaller than those of the young chimpanzee, but in the permanent incisors their positions are reversed. The milk canine of the gorilla does not foreshadow the mighty development attained by its permanent successor. Indeed in size and shape the milk incisors of the gorilla and of the Taungs anthropoid do not greatly differ. In the size of their milk canines, however, there is a vast difference; the South African anthropoid had milk

canines which are reduced almost to a human size. In size and shape of milk molars, however, Australopithecus again takes its place in the anthropoid series, these teeth being smaller than the gorilla's, larger than the chimpanzee's and much larger than the milk molars of an average child. In its milk incisors Australopithecus stands nearest to the gorilla, in its milk canine it approaches the child and in its molar development it stands between the gorilla and chimpanzee, but nearer the former than the latter.[1]

In the preceding pages we have been examining the dentition of the peculiar fossil form which came to light in the quarry at Buxton, and the conclusion which the evidence of the teeth has forced upon us tallies with those drawn from a consideration of brain, skull and face—namely that the being we have to do with, in spite of its many human traits, is essentially anthropoid in nature. Australopithecus was kin to the gorilla, to the chimpanzee and to the orang, but also exhibited, to a greater degree than they do, features which must be counted humanoid.

We now come to the consideration of a matter which has a very direct bearing on the position we are to assign to Australopithecus amongst the higher primates. In Professor Dart's opinion this animal had developed, to some extent at least, the human upright posture—man's power of holding his head and body erect, and of using his lower limbs for purposes of terrestrial progression. He has developed his argument along three lines of evidence—geological, geographical and anatomical. Let us consider the anatomical argument first, because it brings us at once to an important issue—How far can we tell what the posture of an animal was if we have only its skull to guide us?

Let us look at the nature of the problem which has

[1] Professor Dart succeeded in examining the rudiments of the permanent teeth which supplant the milk dentition. From this examination, made by means of X-rays, he infers that these unerupted rudiments foreshadowed teeth which are human in shape and only slightly larger than human in size.

to be solved. In fig. 30 the skull of a young chimpanzee in which the milk teeth are fully up is superimposed upon the skull of an adult female chimpanzee. The reader will see how much the face of the adult exceeds that of the young and that with this facial growth there has been an elongation of that part of the base of the cranial cavity to which the face is attached. It will be also seen that the brain chamber has expanded, but the changes which require our especial attention are those which have affected the foramen magnum—the opening

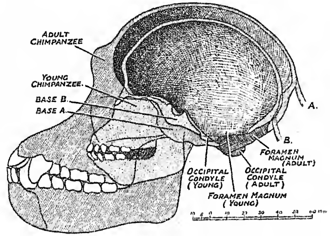


FIG. 30.—Skull of a young chimpanzee superimposed on that of an adult female to show certain age changes, particularly those which affect the position of the foramen magnum. A, Hinder limit of attachment of neck in the adult; B, the attachment in the young.

in the floor of the cavity by which the brain-stem emerges to become the spinal cord. In the young the foramen magnum is nearly horizontal and lies really in the floor of the skull. In the adult, the foramen with the occipital condyles have become thrust backward so as to come nearer to the hinder end of the skull and to be more in line with the occipital part of the base to which the muscles of the neck are attached. In the gorilla the backward thrust is much greater than in the chimpanzee; in man it is much less; the more highly evolved the race of man the more does the foramen magnum seek to retain its infantile position of the floor of the skull. We see herein humanity acquiring new characters by the

retention of those which are temporary and infantile in apes.[1]

Professor Dart rightly drew attention to the forward position of the foramen magnum in the Taungs skull and compared it in this point with adult human skulls of a primitive type. From the similarity in position he drew the inference that Australopithecus must have carried its head and body as man does. The comparison which has to be instituted, however, is not one between the juvenile Australopithecus and adult man but between animals at a corresponding stage of growth. When this is done the Taungs skull takes its place in the anthropoid, not in the human series. The foramen magnum is more forwardly placed in a child of six than in the Taungs skull; the Taungs condition is that seen in a chimpanzee at the end of the milk dentition.

In fig. 31 I introduce an outline of Professor Dart's reconstruction of the head and neck of Australopithecus as seen in profile.[2] The neck is represented as thick, being attached to the head from occiput almost to chin—such a neck as we are familiar with in adult men. Now in the young of all known primates—both human and simian—the neck is slender. The head and neck expand at quite different rates in growing human beings; the head attains nearly its maximum size in youth while the neck keeps time with the general growth of the body, reaching its full size only when full maturity is attained. The same law holds for the growth of the neck of anthropoids, only in their case the cranial cavity being relatively small, the neck has to expand over a greater area of the skull. For instance—as is shown in fig. 30—the fixation of the neck is low down in the young chimpanzee (fig. 30, B) scarcely above the level of the cerebellum, while in the adult it has expanded until it covers the whole occipital aspect (fig. 30, A). In the adult male chimpanzee, and particularly in the male gorilla and

[1] The author has described these cranial changes in the *Journal of Anatomy*, 1910, vol. 44, p. 264.

[2] *Natural History*, 1926, vol. 26, p. 317.

orang, the neck becomes so thick and strong that bony crests are thrown out to give it a sufficient area of fixation. In the adult Australopithecus we expect neck and fora-

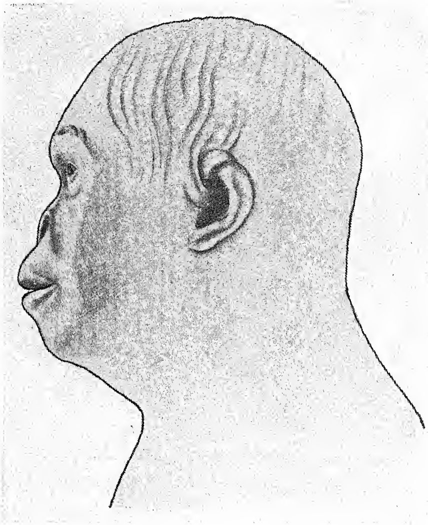


Fig. 31.—Professor Dart's reconstruction of the head and neck of Australopithecus (half natural size).

men magnum to assume the same development as in the chimpanzee.

Whether we count the youthful Australopithecus humanoid or anthropoid in nature, it is certain that its neck was slender, whereas Professor Dart in his reconstruction (fig. 31) has given such a neck as is only known in adult men. Seeing that in its essential characters the

Taungs skull has so many points of affinity to that of the young chimpanzee, I have transposed the outline of the neck of a young chimpanzee to the skull. Such a reconstruction is in keeping with the anatomical evidence. There is thus, in my opinion, no reason for believing, on the evidence supplied by the skull, that

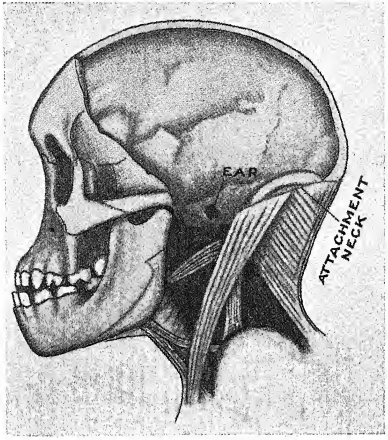


FIG. 32.—Reconstruction of the neck suggested by the author (half natural size).

the posture of Australopithecus differed from that of the young chimpanzee or gorilla.

What, then, was the posture of Australopithecus? How did it get about? The living great anthropoids inhabit jungles; the orang is purely arboreal; the chimpanzee is arboreal but frequents the ground in search of food; the habitat of the gorilla, particularly the male gorilla, lies as much on the ground as on the trees. Gorillas are clumsy walkers and runners, supporting their bodies in

a semi-upright posture by the aid of their arms. If we suppose that the forest belt of tropical Africa, now inhabited by the gorilla and chimpanzee, had extended a thousand miles farther towards Cape Colony than it now does and that the great Kalahari desert was at one time green with vegetation and covered with forest, then there would be no difficulty in explaining how anthropoid apes, practising the gait of the gorilla or of the chimpanzee, came to occupy the district which is now British Bechuanaland. Here Professor Dart meets us with the objection that there is no reason to think that the forest belt ever did extend much farther south than it now does, and that in past geological periods the Kalahari was in no sense a jungle country. This was not the opinion of the late Professor Schwarz, who made a close study of the Kalahari; he found clear evidence of former fertility. Nay, it would be legitimate to cite the discovery of the Taungs skull as evidence that South Africa had at one time been covered with jungle. We accept the fossil remains of Arctic species as evidence of a former severity of climate. On the same grounds we should accept the fossil remains of an anthropoid ape as evidence of a vegetation in South Africa which suits anthropoid needs.

Suppose, however, we accept Professor Dart's contention that South Africa was treeless in past times, is it necessary to infer that Australopithecus had come to use its lower extremities as its sole means of support and of progression? I do not think it is. The adult male gorilla has become almost entirely a ground living animal; were he to leave the fastness of the jungle for the open prairie he would still, I suppose, limp along in an awkward canter as he now does. The baboons which frequent treeless parts of South Africa still retain the grasping hands and feet of the true tree climbers.

Conclusions.—The reader who has followed me thus far may think I have dealt with the discovery at Taungs at far too great a length. I have entered into many wearisome anatomical details. All has been necessary

because of the novelty and importance of the issues raised and the perplexity of the evidence which has to be examined. Former discoveries have caused us to debate whether or not certain fossil forms had reached a human or semi-human status, but the discussion raised by the discovery at Taungs centres round the question as to whether or not Australopithecus had risen above an anthropoid status. Hitherto our inquiries into possible ancestors of the human stock have been made on fossil remains of adult individuals in which the mature features were discernible, but in the discovery at Taungs we have had to deal with an immature being and by analogy infer what it would have become when adult years were reached. We had therefore to inquire into the changes which the human infant and the young ape undergo in passing from infancy to full growth. It has been worth our pains to inquire into the growth changes which transform childhood into manhood, for they are of the same nature as those which in the process of evolution transformed ape into man. For these reasons it has seemed to me necessary to deal with the Taungs problem in a detailed manner.

A close examination of all the features of the Taungs skull—the size and configuration of the brain, the composition of the cranial walls, the features of face, the characters of jaws and teeth and the manner in which the head was hafted to the neck—leave me in no doubt as to the nature of the animal to which the skull formed part; Australopithecus was an anthropoid ape. In its adult form it would have had a closer resemblance to the chimpanzee than to the gorilla or to any other anthropoid of which we have knowledge. In other characters—in size of brain and in certain characters of teeth Australopithecus made contacts with the gorilla. It was of the same stock as the chimpanzee and gorilla; it is a cousin form. And yet in other directions it made an approach to the human state—particularly in volume of brain, in size of milk canines and in the undue persistence of infantile traits. It was certainly more human

in its characterization than either gorilla or chimpanzee.

If the geological evidence had been such as would have permitted us to attribute Australopithecus to a miocene date, then we should have had to consider seriously Professor Dart's contention that in Australopithecus we have a representative of a prehuman stage of man's ancestry. For most of us who have inquired into the evidence relating to man's evolution are convinced that man has passed through an anthropoid stage, and of all the fossil apes yet discovered Australopithecus comes nearer to our expectation of what our anthropoid ancestor should be like, than any which has come to light so far. Geological evidence, however, compels us to abandon a miocene date for Australopithecus and to attribute it to a geological period when we know that man was already in existence. All the evidence bearing on Australopithecus is best explained by supposing it to have sprung as a branch of the phylum which gave us the gorilla and chimpanzee, and not as Professor Dart contends, from the root of the human phylum (fig. 8, p. 51). That Australopithecus should manifest humanoid characters more prominently than either the chimpanzee or gorilla need not astonish us; the great anthropoids and man have a common inheritance drawn from the same stem (fig. 8). In brief the discovery at Taungs has given us not a human ancestor but an extinct cousin of the gorilla and chimpanzee. But it has also provided those who seek man's origin in the ancestry of the great anthropoids with strong support. Further, we may regard the gorilla, chimpanzee and Australopithecus as a series in which the chimpanzee represents the older and more primitive form. From this central type the gorilla has evolved in the direction of increased brutalization, while Australopithecus has branched in an opposite direction, thus assuming many human traits.

CHAPTER VII

ANCIENT TYPES OF MAN IN SOUTH AFRICA

IN 1924, when I made my last survey of the evidence bearing on the antiquity of man in South Africa,[1] only two fossil human types were known, Rhodesian man and Boskop man. In neither case were we able to assign a date to these extinct types of humanity; both geological and archaeological evidence were lacking. In recent years our knowledge of the stone ages of South Africa has made great progress; we now feel confident that the palaeolithic cultures of this part of the world are just as old as those of Europe. There is, too, a curious parallelism or correspondence in the sequence of cultures; the ancient inhabitants of South Africa and of Europe seem to have made the same crude beginnings; both commenced with roughly fashioned hand-axes of pre-Chellean types early in the pleistocene period or even earlier, and by similar stages reached the same final forms.[2] Although we have not sufficient evidence to permit us to assign the Boskop and Rhodesian types to their respective places in the scale of South African cultures, yet it is in keeping with our present knowledge to regard Boskop man as being late palaeolithic in date, practising a culture corresponding to the Aurignacian in Europe. The date of Rhodesian man is a more difficult problem. In brain and skull he is so primitive that, were we moved by anatomical evidence alone, we should place him at the very beginning of the pleistocene series of cultures, but if we give geological evidence full weight, it does seem possible that he may have survived long enough to become contemporary with Neanderthal man in Europe, and he may have shaped his stone tools after the Mousterian manner.

[1] *Antiquity of Man*, vol. i, chapter xix; vol. ii, chapters xx, xxi.

[2] For recent information concerning the stone cultures of South Africa, see *The Stone Age in Rhodesia*, by Neville Jones (1916); *South Africa's Past in Stone and Paint*, by M. C. Burkitt (1928).

In a previous volume I have dealt fully with the anatomical characters of Rhodesian man,[1] and should not have returned to them again had not certain of my conclusions been called in question by two distinguished anthropologists—Dr. Alĕs Hrdlička,[2] of the Smithsonian Institution, Washington, and by Mr. W. P. Pycraft[3] of the Natural History Museum, South Kensington. It will be remembered that in the depth of the mine at Broken Hill, Northern Rhodesia, there was found not only the skull of Rhodesian man, but also other bones attributed to him—a sacrum, part of a hip bone, the upper and lower pieces of a femur and a tibia. Besides these fossil bones, there were also found a fragment of an upper jaw, a hip bone (nearly complete) and part of a thigh bone which might very well have been united in the body of a second individual—a woman. Now there is no doubt that a cave extended into the mine or quarry at Broken Hill to a depth of 60 feet below the surface, and that on the morning of June 17, 1921, a human skull and other fossil bones were found in the debris thrown out after blasting had been carried out in that part of the mine where the lower end of the filled-up cave was known to be situated. In 1925 Dr. Hrdlička[4] visited Broken Hill and collected evidence at the mine from men who were employed when the skull was discovered. The skull and the other bones, he learned, were not found together nor at the same time; they were found some distance apart but in the same mass of debris. Seeing how primitive is the skull in so

[1] *Antiquity of Man*, vol. ii, chapters xx, xxi.

[2] "Rhodesian Man", *Amer. Journ. Physical Anthrop.*, 1926, vol. 9, p. 173. See also *The Skeletal Remains of Early Man*, p. 98 (Washington, 1930).

[3] *Rhodesian Man and Associated Remains*. By William Plane Pycraft, G. Elliot-Smith, F.R.S., Macleod Yearsley, F.R.C.S., J. Thornton Carter, Reginald A. Smith, A. Tindell Hopwood, Dorothea M. A. Bate and W. E. Swinton. With an introduction by F. A. Bather, M.A., D.Sc., F.R.S. Printed by order of the Trustees of the British Museum, 1928.

[4] Dr. Hrdlička found in outhouses at the mine the lower end of a humerus and part of a parietal bone which were apparently found at the same time as the skull. These he has presented to the Natural History Museum, South Kensington.

many of its features and how modern are the bones of the limbs and pelvis in most of theirs, Dr. Hrdlička has called in question the propriety of linking skull and limb bones together and regarding them as parts of the same individual. The problem is of a kind which has been raised in connection with every important discovery of fossil man. In the case of Piltdown man the lower jaw was rejected by some because it was not found with the skull fragments and because it presented features which until then had not been seen in a human jaw. The femur of Pithecanthropus lay at some distance from the skull; the skull was simian in its outward appearance, while the thigh bone was human. Anatomists have to face the same problem every time they are presented with the mingled bones from a common grave; it is often possible from texture, colouring and conformation to sort out the bones of each individual. In the case of the Rhodesian find there should not be any hesitation in assigning the tibia to the skull; in texture, preservation, conformation and colouring the tibia answers to the skull. Nor do I think there is much room for doubt that the stronger thigh bone, the imperfect hip bone and the sacrum go with the skull. It is quite true, as Dr. Hrdlička asserts, that our conception of Rhodesian man is profoundly influenced by the character of the limb bones we ascribe to him; did we know only his skull, we should regard him as a possible ancestor of Neanderthal man; his limb bones separate him widely from Neanderthal man and reveal his close relationship to neanthropic or modern man.

Suppose for a moment we refuse to associate the Rhodesian skull with the limb bones. Then we have to explain how it came about that a human skull with very primitive characters became associated in the depth of a cave with limb bones which, although modern in the main, yet possess an assortment of peculiar features. If we regard the Piltdown mandible as that of a chimpanzee with human leanings, then we have to explain how it came to be embedded in the same pocket of gravel as

a skull which is marked by so many early and peculiar characters. In the case of Pithecanthropus we have to regard skull, teeth and thigh bone as parts of the same body or suppose that by some rare chance three beings, all in different stages of human evolution, became mingled together in the gravel bed of an ancient stream. If the theory of evolution is true, and it is the only theory which explains the diversity and history of living forms, then the discoveries at Piltdown in Sussex, at Trinil in Java, and in the Broken Hill mine, Northern Rhodesia, should not surprise us. Fossil forms in which humanoid and anthropoid characters mingle are just what we ought to find if the theory of man's simian origin is well-founded. It will be seen that I am far from sharing my friend Dr. Hrdlička's doubt as to the limb bones being those of Rhodesian man.

Mr. Pycraft's criticism of the status usually assigned to Rhodesian man differs altogether from that of Dr. Hrdlička. He accepts the limb bones just specified as those of Rhodesian man, but finds evidence in the hip bone that Rhodesian man differed so radically from all other extinct species of mankind that he proposes to make him the type of a new genus of humanity under the name *Cyphanthropus*—or "stooping-man". Having made a very detailed examination of all the Rhodesian bones in 1923, noting the strength and straightness of tibia and femoral fragments, and the exact correspondence in joint surfaces at knee, hip and sacrum to those of the most erect types of modern humanity, I had not any doubt that in his posture of body and in his gait Rhodesian man differed in no essential way from modern man. I was therefore somewhat surprised to receive a note from Mr. Pycraft on April 27, 1927, inviting me to be present at a meeting of the Linnean Society next day when he was to describe an unnoted but important feature of the hip bone of Rhodesian man—one which radically altered our conception of the nature of that primitive being. Evidently Mr. Pycraft's younger and less experienced eyes had noted some important point

in the fragment of the male hip bone—for the other and more complete hip bone is that of a woman. I attended the meeting and found that the discovery made by Mr. Pycraft was of the following nature.

The socket or acetabulum for the head of the thigh bone is made up by contributions from each of the three elements of the hip bone (os innominatum)—$\frac{2}{5}$ by the ilium, $\frac{2}{5}$ by the ischium and $\frac{1}{5}$ by the pubis (fig. 33). This law holds not only for man, but also for all members of the primate order: In the reconstructed Rhodesian hip bone shown by Mr. Pycraft at the meeting of the Linnean Society almost the whole of the ischial element was omitted from the acetabulum or hip-socket.[1] If Mr. Pycraft's reconstruction was right, then Rhodesian man was a very peculiar individual indeed and deserved to be made the type, not of a separate species or genus, but of a new order. The nature and extent of Mr. Pycraft's misinterpretation of the Rhodesian hip bone was subsequently explained by Professor LeGros Clark.[2]

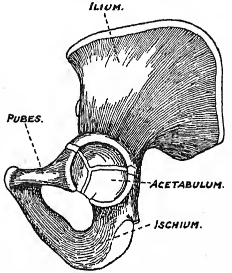


FIG. 33.—Left hip bone of an adolescent to show the three elements—ilium, ischium and pubis, which contribute to the wall of the acetabulum.

In his first reconstruction Mr. Pycraft omitted from the acetabulum almost the whole of its ischial element; only the amount of articular surface represented by A in fig. 34 was inserted. In a reconstruction described two years later[3] a much larger representation was given to the ischial element (fig. 34, B) and the missing pubic and ischial rami were restored more in keeping with the

1 This—his original reconstruction—is depicted in fig. 2, Plate N, *Man*, 1928, vol. 28.

2 *Ibid.*, p. 206. In the same number of *Man* (No. 149) Mr. Pycraft gives the reasons for his reconstruction in detail.

3 *Ibid.*, 1930, vol. 30, p. 117.

elementary laws of vertebrate anatomy. When the ischial element of the acetabulum is extended to an extent normal to mankind—ancient and modern (fig. 34, C)—a new name for Rhodesian man is no longer required.

When these omitted parts are restored the Rhodesian fragment becomes a stout hip bone of the modern type. No doubt it has certain minor peculiarities such as we

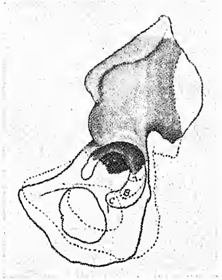


Fig. 34.—Hip bone of a modern European viewed from the side—in true profile. The area which is shaded represents the part of the Rhodesian hip bone which was found. The stippled outline represents Mr. Pycraft's reconstruction of the missing ischial and pubic parts of the Rhodesian bone, the continuous outline those of the modern bone.

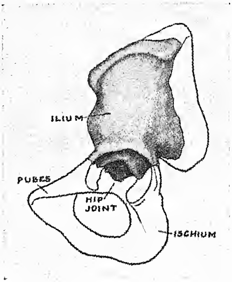


Fig. 35.—Mr. Pycraft's second reconstruction of the Rhodesian hip bone. The reconstruction has been placed in the same position as in the hip bone shown in fig. 34.

should expect in man whose tibia was particularly straight and stout. Thus there is no need to change the original name given by Sir Arthur Smith Woodward to Rhodesian man—*Homo rhodensiensis*. Rhodesian man has certain points of kinship to Neanderthal man,[1] but stands in his major characters nearer the ancestral line of modern man (see frontispiece).

[1] Dr. G. M. Morant has given a minute analysis of the relationship of Rhodesian man to other extinct human types, in *Annals of Eugenics*, 1928, vol. 3, p. 337.

Although nothing has happened since 1924 to throw light on the exact period at which the Southern Transvaal was inhabited by men of the Boskop type, yet certain recent discoveries help to clear up the relationship of the Boskop type to other races of South Africa.[1] It will be remembered that Mr. F. W. Fitzsimmons[2] discovered in certain cave burials at Tzitzikama—in coastal cliffs to the west of Port Elizabeth, Cape Province—people of the Boskop type, a negroid people with large and long heads and relatively small faces. Mr. Fitzsimmons has now discovered over fifty such burials, and it has been demonstrated that the Boskop type merges into a later people—the Strandloopers. The Strandloopers in turn merge into the smaller-headed Bushman and Hottentot types. The Boskop type, if not a direct ancestor of the Bushman, yet stands near the line which evolved into this type. Occasional Bushmen possess large heads of the Boskop type. One example recently described by Professor M. R. Drennan,[3] of Capetown University, had a skull which exceeded the Boskop specimen in all dimensions, its cranial capacity being 2000 c.c.—at least 300 c.c. more than the Boskop capacity. Unfortunately nothing was known of the mental ability of this massive-brained Bushman.

Dr. J. C. Middleton Shaw[4] has drawn attention to a curious change which is often seen in the molar teeth of South African natives—both past and present—of the Boskopoid type. The change is somewhat of the same nature as that seen in the molar teeth of Neanderthal man.[5] The pulp cavities in these South African teeth enlarge downwards into the body of the molars, while the roots are short and tend to become bent inwards and united. The Taurodontism described by Dr. Middle-

[1] A description of the Boskop skull by Mr. W. P. Pycraft was published in the *Journ. Roy. Anthrop. Institute* 1925, vol. 55, p. 179.

[2] See *Antiquity of Man*, vol. i, p. 372.

[3] *Illustrated London News*, September 5, 1925, p. 432.

[4] "Taurodont Teeth in South African Races", *Journ. of Anatomy*, 1928, vol. 62, p. 477.

[5] See *Antiquity of Man*, vol. ii, p. 682.

ton Shaw is of a limited character; the cylindrical molars of Neanderthal man have not been met with.

The evidence that man was the contemporary in South Africa of many strange and extinct forms of large mammals grows in strength and precision. In 1927 diamond diggers while excavating a portion of the old bed of the Vaal River near Bloemhof, in the south-western corner of the Transvaal, discovered two fossil molar teeth. These teeth, as Professor Raymond Dart[1] has proved, betoken the existence of two undescribed kinds of elephant in South Africa in pleistocene times. In the same gravels, which represent an ancient bed in the Vaal, were found many thousands of unmistakable stone implements. These were of earlier types—the types which correspond to the Chellean and Acheulean implements of Europe. Some way up the sides of the valley—about 60 feet above the present level of the Vaal—are the remnants of a still older bed of the river. In this terrace, too, are found numerous stone implements of the earliest cultures and also the fossil remains of still another kind of extinct proboscidean, the Mastodon. Altogether fossil remains of eight species of elephant, representing three genera, have been found in pleistocene deposits of Africa south of the equator.[2] In the same deposits have been found stone implements shaped by man. It seems highly probable that man hunted these fossil types until he extinguished them. It is difficult to believe that the fauna represented in the filled-in caves at Buxton is older than that found in the oldest pleistocene terrace of the Vaal.

The south-western corner of the Transvaal has become the "Dordogne" of South Africa, so full is it of the relics of ancient man. This area—the Lichtenburg district—is drained by the Harts River which passes Taungs on its way to the Vaal. Taungs, where Mr. Neville Jones demonstrated a succession of cultures in the deposits of the Harts River, is only 50 miles as the crow flies

[1] "Mammoths and Man in the Transvaal", *Nature* Supplement, December 10, 1927.

[2] Henry Fairfield Osborn, *Nature*, 1928, vol. 121, p. 672.

from the gravels at Bloemhof where the implements of ancient man lie mingled with the fossil teeth of the southern mammoth and of the mastodon. In the upper valley of the Harts River, which lies in the Lichtenburg district of the Transvaal, are found many wonderful works of art punched upon the face of rocks by palaeolithic hunters. Many of these petroglyphs have been saved from destruction and preserved in the Transvaal Museum at Pretoria, where they have been studied by Mr. Herbert Lang.[1] The animals which we do know, such as the rhinoceros and hippopotamus, are rendered so faithfully and so graphically by these ancient hunter-artists that we may accept their representation of animals which no longer exist—such as the mastodon—as equally true to life. Mr. Lang, who has published illustrated accounts of these ancient works of art,[2] has found amongst them representations of ten species of great mammals which are now extinct. It is possible, as we shall see in the next chapter, that the fossil remains of one of these hunter-artists has been discovered. Thus we have the most incontrovertible evidence that man existed in South Africa when many forms of great mammals, now extinct, were abundant. This does not mean that the antiquity of man in South Africa is necessarily great. It depends on when extinction overtook South Africa's lost fauna; if man was the active cause of its extinction, as seems probable, then it is not necessary to suppose that the petroglyphs are older than kindred works of art in Europe. If this point of view is right, the art of the hunters may not have reached South Africa until some 15,000 or 20,000 years ago.

[1] *Illustrated London News*, July 14, October 6, 1928.
[2] *Ibid.*, July 13, July 27, 1929.

CHAPTER VIII

FISH HOEK MAN. THE ANCESTRY OF THE BUSHMAN

Fish Hoek is situated on False Bay, 15 miles due south of Cape Town (fig. 36). Crossing the base of Cape Peninsula, with the township of Fish Hoek at its eastern end, is a wide valley; about half-way along this valley a hill, crowned with sandstone cliffs, rises up to a height

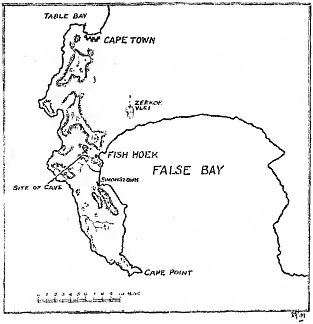


Fig. 36.—Sketch map of the Cape Peninsula showing the site of Skildergat cave wherein the fossil remains of Fish Hoek man were discovered. (Sketch by Mr. B. Peers, the discoverer.)

of 400 feet. On the south-western aspect of its cliff-like summit opens an ample cave—the Skildergat cave. Its opening is low—only 12 feet (3·6 m.) in height, but it is wide, measuring from side to side 100 feet (30 m.); the cave is deep; from the edge of the terrace in front to its hinder wall there is a depth of 44 feet (13·5 m.). One might well suppose that such a cave, sheltered as it is from the north winds, easily defended, near to fresh water, to valley country and to seashore provided an ideal home for prehistoric man. The credit of having proved that Skildergat cave had provided a home for

paleeolithic man throughout a long period of prehistoric time rests with Mr. B. Peers and his son Mr. B. Peers, Jun.

Mr. Peers and his son live in Fish Hoek; for many years they have spent their week-ends and holidays in searching geological deposits for fossil remains of the fauna of South Africa, but in later years they have given such time as their occupations permitted to the examination of sites whereon prehistoric man had made his camps. They had their eye on the Skildergat cave, but wisely, before embarking on so responsible a task as its excavation presented, devoted themselves to acquiring and perfecting the technique which modern archaeology demands of its votaries. It was not until May 1927 that these archaeological volunteers, by the right use of the spade, dynamite and foot rule, began to decipher the records buried in the depths of Skildergat cave. They were fortunate, too, in having Mr. A. J. H. Goodwin of the University of Capetown to advise them in determining the stone cultures met with, and Professor M. R. Drennan of the same University to describe for them the human remains which came to light as they proceeded. When the British Association visited South Africa in 1929, its members were able to examine a section of the floor of the cave, which then reached a depth of twelve feet and exposed the five upper strata.

In fig. 37 Mr. Peers gives the reader a synopsis of what was discovered after two years of labour. The floor of the cave is shown in section from front to back, five strata being exposed, but there are reasons for believing that the floor extends to a depth of over 20 feet. The top stratum need not detain us; it is recent and about 6 inches in depth. Then came a stratum, 3 to 5 feet in thickness, made up mostly of sea-shells—really a midden heap trod underfoot when the cave was occupied by Standloopers—a people near akin to the Bushman. Indeed, they were Bushmen, for the six skeletons buried in this stratum, lying on their sides with their limbs bent on their bodies, were marked by Bush-

man characters. Then under the shell stratum came one of great thickness—6½ feet—and of exceptional importance. The stone industry contained in this stratum goes under the name of "Still Bay"—the name being derived from a site on the south-coast of Cape Province—200 miles to the east of the Cape Peninsula. So long had Skildergat cave been occupied by the "Still Bay" people that their industry had passed through a series of

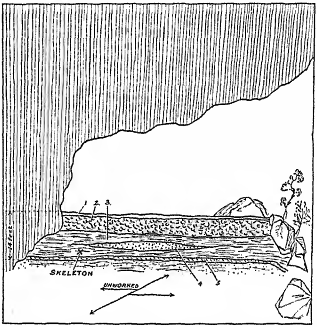


FIG. 37.—Section of the strata of the cave floor, from terrace to hind wall. The site of the deepest burial, that of the Fish Hoek man, is marked by X (B. Peers). For explanation of strata, see fig. 38.

evolutionary changes. And yet the cave had not been continuously occupied by people practising this industry, for a lenticular-shaped stratum (fig. 37, 4), containing another but allied industry (Howieson Poort), cuts across the main stratum, separating its deeper and older from its upper and more recent layers. In the deeper part of the Still Bay stratum, but not far beneath the interpolated culture (4), was found a complete burial in an excellent state of preservation. The Still Bay culture is marked by strong Mousterian influences; it is usually regarded as the equivalent to the Solutrean of Europe (fig. 162, p. 464).

It was expected that when the men responsible for the Still Bay culture in South Africa were discovered, they would prove to be of a primitive—perhaps Neanderthaloid—type. The excavation of Skildergat revealed for the first time in South Africa a human skeleton embedded

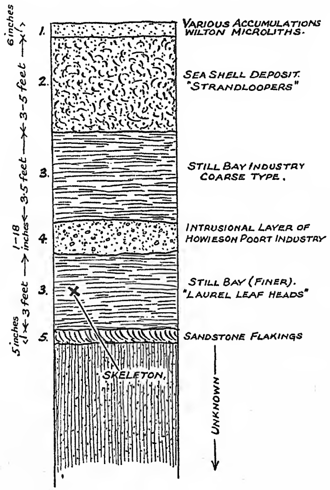


FIG. 38.—Diagram of the strata of Skildergat cave with industries indicated. (B. Peers.)

in an intact and datable palaeolithic stratum. The result was somewhat unexpected. Professor Drennan at once recognized that the fossil remains were those of a Bushman but one of a primitive and remarkable kind. I have had an opportunity of examining the skull from the deep stratum of Skildergat cave and can confirm Professor Drennan's diagnosis in every detail.

Before proceeding to compare this ancient Bushman

with his modern successors, let us first see how far we can ascertain his place in the scale of palaeolithic antiquity. In fig. 38 is reproduced Mr. Peers's diagram of the cultural successions found in the strata of the Skildergat cave. The Still Bay culture, in the deepest part of stratum 3, begins with finer "laurel leaf heads" and ends above in a "coarse-type". The Howieson Poort industry is interpolated. Then follows the shell-midden (Smithfield) industry and lastly a pygmy or microlithic (Wilton) industry. Except to expert students, such a succession of names and cultures gives only a vague idea of the age of the cultural stratum in which the skeleton of the primitive Bushman was discovered. If, however, we journey some 1200 miles to the north and visit the Bambata cave in the Matopo Hills to the south of Bulawayo, Rhodesia, we shall obtain a clue to the cultural deposits in which the Fish Hoek man was entombed. Bambata cave was prospected by the Rev. Neville Jones in 1918,[1] but it was not until eleven years later—when the British Association visited South Africa—that a systematic examination of its deposits was made. The excavation of the cave was entrusted to a member of the Association, Mr. A. Leslie Armstrong, who has been responsible for the systematic exploration of so many of our British caves.[2]

An extract from a letter which Mr. Armstrong wrote to me on his return from South Africa in the autumn of 1929 will place the reader in possession of the main facts relating to the Bambata cave in Rhodesia:—

"Our work in Rhodesia was more fruitful than I dared to hope. For the first time we got a complete stratification in one site, ranging from Stellenbosch at the base (the Acheulean of South Africa) to an early microlithic culture, a form of Wilton,[3] at the top. There was a rich

[1] *Stone Age in Rhodesia,* 1926.

[2] See Chapter XXVII, p. 420.

[3] The reader who wishes to compare the South African cultures with those of Europe should consult fig. 162, p. 464. The Wilton culture of South Africa represents the Azilian (Tardenoisean of Europe). The human remains associated with Mousterian deposits in Europe are always of the Neanderthal type.

Mousterian layer covering the Stellenbosch and above this a great thickness of palaeolithic material, 10 to 12 feet of it, containing a culture *obviously ancestral to 'Still Bay'*. At the base of this material—the stratum measuring 10 to 12 feet in thickness—are Mousterian *points* of classic form in association with Aurignacian; or more correctly—Capsian-implements and many burins. The Mousterian influences predominate throughout, but the *points* develop into the '*Still Bay*' type and technique to that of Solutre. The total depth of the section was 20 feet and it was rich in artefacts throughout. It is a painted cave, there being at least three superimpositions of paintings."

The bearing of the discoveries made by Mr. Armstrong in the Bambata cave on those made at Skildergat by Mr. Peers must be apparent to the reader. It is also remarkable that a trial trench at Skildergat revealed at the base of the cave deposits there—at a depth of 20 feet—a stratum containing implements of the hand-axe type, Stellenbosch or Acheulean. In Bambata, however, it was possible to follow the evolution of the "Still Bay" industry—the industry which marks the deposits in which the Fish Hoek man was buried. In Europe the Aurignacian industry succeeds the Mousterian, but in Africa these two industries (Mousterian and Aurignacian) may alternate; they may be separate or they may be fused. It was out of a fusion of the two that the industry (Still Bay) of the Fish Hoek man was evolved. We cannot greatly err, then, if we assign a date to the "Still Bay" industry which corresponds to that which we give in our time chart (see fig. 162, p. 464) to the Solutrean industry of Europe. We may therefore regard the Fish Hoek man as a representative of the people who inhabited South Africa some 15,000 years ago.

Let us now pass in brief review the chief features of the Fish Hoek skull. It is that of a man probably about thirty years of age and its characters are, as Professor Drennan recognized, those of the Bushman. It differs, however, from modern Bush skulls in many respects;

it is more capacious, its brain space being at least 1600 c.c., some 150 c.c. above the mean for modern Bushmen. It is long, measuring 200 mm. (see fig. 39), relatively low, the vault rising 114 mm. above the ear passages. Especially remarkable is the great extension backwards of the skull behind the ears. Notwithstanding its great size, the outline of the skull as seen in profile is that which we usually see in the skulls of modern

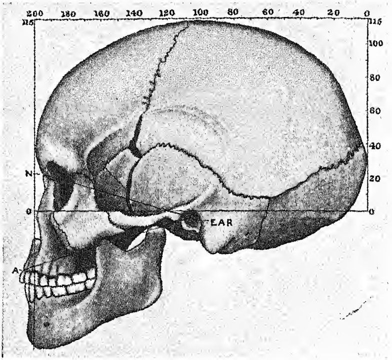


FIG. 39.—Profile of the Fish Hoek skull. It is oriented on the Frankfort plane. (E. Smith.)

Bushmen. Characteristic, too, is the small size of the face, as seen in profile (fig. 39). The total length of the face from nasion to lower border of chin is only 107 mm.; the length of the upper face, from nasion to alveolar border of upper jaw, only 58 mm. The jaws project unduly forwards (fig. 39), but this is due not so much to the size of jaws as to curtailment in the length of the base of the skull in front of the ears. For example, if we take the distance from the ear to the nasion as seen in profile (fig. 39), it is only 90 mm.—much less than in

European skulls, while the corresponding distance to the most projecting point of the upper jaw (fig. 39) is 102 mm.—a quite common measurement. The lower side of the facial triangle is 11 mm. greater than the upper—an excess of more than 10 per cent.—a degree of prognathism nearly equal to that of the Taungs anthropoid.

When we view the Fish Hoek skull in full face we

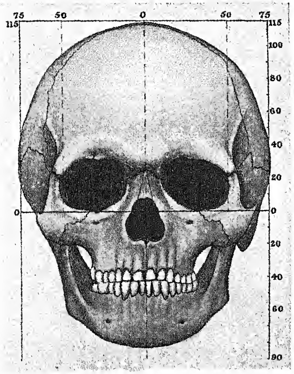


FIG. 40.—Fish Hoek skull seen in full face. Oriented on the Frankfort plane. (E. Smith.)

meet with other surprising features. The sides of the skull (fig. 40) swell out low down—the greatest width being 150 mm.—75 per cent. of the length. The forehead is wide—105 mm.—and the supra-orbital ridges much more strongly marked than in the skulls of modern Bushmen. The supra-orbital width is 111 mm.—6 mm. more than the frontal width. The bony partition between the orbits is wide (28 mm.) and flat, as is the rule in Bush skulls. The nasal bones—forming a flat triangle—

are greatly reduced in size (fig. 40), a condition we meet with in two modern human stocks—the negro and Mongol. The nose is short (42 mm.) and of medium width (25 mm.). The cheek bones are moderately prominent, due to the great development of the maxillary buttresses which support them from below. The width

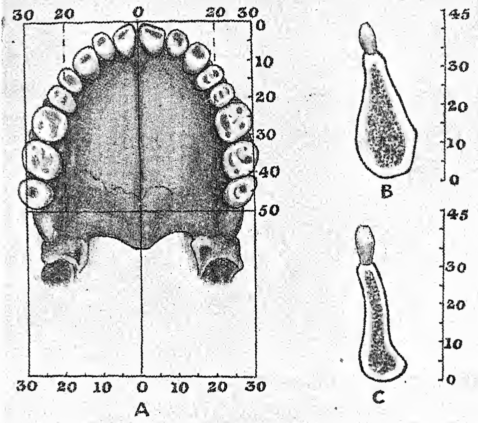


FIG. 41.—The dental arch of the upper jaw of the Fish Hoek skull. B. Section of the symphysis of the Fish Hoek mandible. C. Section of the symphysis of the mandible of a modern Bushman.

of the face measured between the zygomatic arches is 136 mm.—16 mm. more than is usual in modern Bushmen, while the width between the angles of the jaws is 98 mm.—8 mm. more than is usual in the Bushmen of to-day.

All the features we have just enumerated—prominence of supra-orbital ridges, outstanding cheek bones, wide zygomatic arches, strong jaws—are indications of power-

fully developed muscles of mastication. And yet, when we turn to the palate, the most reliable index of masticatory development, we find one of small size (fig. 41). The total area contained within the outer margin of the dental arch is only 24 $cm.^2$—1 $cm.^2$ less than in modern Bushmen. The length of the dental arch (fig. 41, A) is only 47 mm. and its width opposite the second pair of molar teeth 62·5 mm. The teeth are small—a characteristic of Bushmen as compared with negroes. The total length of the three upper molars is only 27 mm., which is slightly less than in modern Bushmen.[1]

Having ascertained the area of the palate (24 $cm.^2$) and the cranial capacity (1600 c.c.) we are now in a position to work out the palato-cerebral ratio[2] of the Fish Hoek man. The result is remarkable. For each cm^2. of palate there are 66·6 c.c. of brain space; the palato-cerebral ratio is 1 : 66·6—a higher ratio than has been observed in any human skull of palaeolithic date. To find a parallel state we have to make our comparison with the immature of other races. A European lad about his fourteenth or fifteenth year often shows a similar palato-cerebral ratio. In the later years of adolescence the palate grows more quickly than the brain, and the ratio sinks in Europeans to 1 : 60 or less. We can best explain the large brain and small palate of the Fish Hoek man by supposing that maturity is reached at a stage corresponding to adolescence in other races. All the features of dwarf races of mankind are to be so explained—their short stature, their big heads, small faces and buoyant mentality. Dwarf races, when they mature, retain the adolescent stage of other races. The Fish Hoek man was about 5 ft. 2 in. high (femur length 435 mm.); he was tall for a Bushman. Yet even in stature he was on the border line of dwarfdom.

We may turn aside a moment from the course of our argument to compare the Fish Hoek skull with that of

[1] Professor M. R. Drennan, "The Dentition of a Bushman Tribe", *Annals of the South African Museum*, 1929, vol. 24, p. 61.

[2] See a table given, vol. ii, p. 659, *Antiquity of Man*.

modern Bushmen. In fig. 42 I have superimposed on the profile of the Fish Hoek skull a composite outline, representing means derived from the measurement of three skulls of modern Bushmen. Ear has been placed over ear and the Frankfort plane of the one superimposed on that of the other. It will be seen that the Fish Hoek

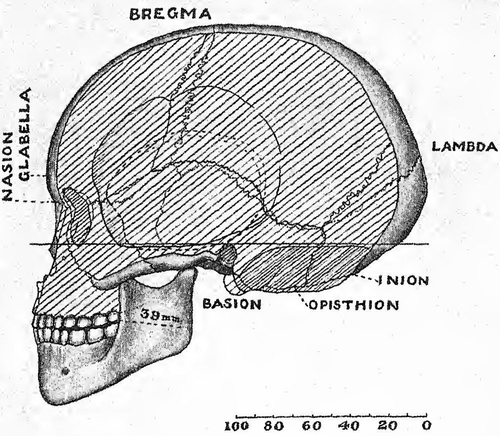


FIG. 42.—Composite profile of three skulls of modern Bushmen (marked by hatching) superimposed on that of the Fish Hoek skull. Ear is placed over ear and the Frankfort planes coincide.

skull (cerebral part) exceeds that of the modern Bushman in all directions—but particularly is the excess great behind, to a less degree in front, least of all as regards height of vault. On the other hand, the face of the modern Bushman is just as large and just as prognathous as in the fossil Bushman.

Although the palate and face are as large in the

modern as in the ancient Bushman, there are instructive points of difference. This difference is exemplified in fig. 41, B, C, where sections of the symphysis of the lower jaw are compared. In height the ancient and modern chins are nearly alike, but the modern is only 11·5 mm. thick, while the ancient is 16 mm. The same difference in strength of bone is seen in the ascending ramus of the lower jaw; its width, measured as in fig. 42, is 39 mm.; in the modern jaw the width is 35 mm. In fig. 42 the zygomatic arches of the fossil skull are seen to be greatly stronger than in the modern skull. The supra-orbital ridges of the ancient skull are much more pronounced than in modern Bushmen. The cranial walls of the ancient skull (along the vault) vary in thickness from 6 to 8 mm., being slightly thicker than in modern Bush skulls.

I have contrasted the strength of the bony struts in the face and skull of the ancient and of the modern Bushman for a particular reason. There is a parallelism between the Fish Hoek man of South Africa and the Cromagnon[1] of France. Their dates are probably not very different. The Cromagnons are the earliest representatives of the modern type of European we have any knowledge of; the Fish Hoek man is the ancestor of the Bushman—a type which at one time was the sole occupant of South Africa. The two types were alike in this—both were big-brained—but whereas the Cromagnon type was particularly tall, the Fish Hoek type was short of stature, almost a dwarf. One is an early Caucasian; the other is an early South African, or Fish Hoekian. Now, in the course of time the Caucasian features, as represented by the Cromagnon people, have become modified; their brains have not enlarged; their jaws and the bony structure of their faces have become reduced. We have attributed the reduction in our size of jaw and strength of facial support to effects brought about by modern dietary. The Bushman, however, until quite recent times, has remained the untamed nomad of nature; we can

[1] See *Antiquity of Man*, vol. i, p. 97.

hardly attribute his reduction in strength of jaw and of bony prop to a change of diet. Evolution seems to bring about changes in human type from causes which are inherent in the physiology of our bodies, rather than from outward causes—such as change of diet or modification in modes of living. At least the changes undergone

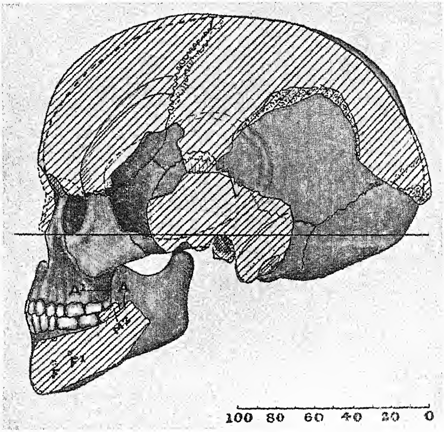


FIG. 43.—The profile of the Boskop skull (hatched) superimposed on that of the Fish Hoek skull. The mandibular fragment has been superimposed so that chin corresponds to chin.

by the Cromagnon type of Europe and the Fish Hoek type of South Africa are very similar, and yet the conditions of life in Europe and in South Africa since late pleistocene times have been very different.

What is the relation of the Boskop man[1] to the Fish Hoek man? We do not know the geological age of the Boskop man, but I believe he must be earlier than the Fish Hoek man for this reason. In fig. 43 the Boskop is

[1] See *Antiquity of Man*, vol. i, p. 367, fig. 130.

superimposed on the Fish Hoek skull; it extends beyond the limits of the Fish Hoek skull almost as much as the latter did the skull of the modern Bushman. I have superimposed the mandibular fragment of the Boskop lower jaw on the Hoek mandible, so that chin corresponds to chin. But in doing so I have had to place the Boskop fragment out of its proper relationships. To make the 2nd molar tooth (fig. 43, M^2), the mental foramen and the anterior borders of the ascending ramus of the two specimens coincide, the Boskop chin has to be advanced almost half an inch in front of the Fish Hoek chin.[1] From which we infer that the Boskop man, who was larger brained than Fish Hoek man, was also larger jawed and more prognathous. I therefore suppose Boskop to be an earlier form, but it is an earlier form of the Fish Hoek type—the Bushman type.

Archaeologists, in seeking to trace the origins of South African cultures to the Sahara and to Africa north of the Sahara, are apt to assume that there has always been a drift southwards of the peoples of Africa and that we should find the ancestors of the Bushman on the shores of the ancient Mediterranean. All the evidence we have gathered in recent years points to South Africa as the evolutionary cradle of the Bushman type. He is an African type. His peppercorn hair and many other traits indicate that Negro and Bushman are the descendants of a common ancestry. And of all the evolutionary products of humanity known to us the Bushman type is the most remarkable. In its ancestral form it is the largest-brained type of humanity so far discovered. What use did the Boskop and Fish Hoek folk make of their cerebral endowments? I would point to the remarkable works of art scattered through South Africa.[2] Yet the fact remains that the ancient Boskop type has degenerated into its modern representative, the modern Bushman, speeding fast towards utter extinction. A great brain endowment has not saved this type. Nay, the very fact that

[1] Dr. Robert Broom has noted the peculiar nature of the Boskop mandible. *Nature*, 1925, vol. 116, p. 897.

[2] See Chapter VII, p. 125.

the Boskop people were so richly endowed with mass of brain and apparently made so little effective use of it, has led many to doubt if size of brain has any direct relationship to mental ability. If the ability postulated is of the kind needed to make a success in a world ruled by rigid economic standards, then brain mass is useless as an indication. But if size of brain is correlated with a capacity to enjoy life, may it not be that Boskop man, Fish Hoek man and the modern monster-brained hybrid described by Professor Drennan[1] have tasted its sweets to a degree which we cannot fathom?

At no great distance from the Skildergat cave, where the Fish Hoek remains were found, a flat belt of land crosses the base of the Cape Peninsula known as the Cape Flats. Wind-blown sand covers the flats, burying an old land surface to a depth of 6 feet and in some parts to as much as 14 feet. The sand is quarried and thus the old land surface becomes exposed. On searching the debris thrown out by quarry-men, Professor Drennan discovered fragments of human skulls in a fossil state and also various kinds of artefacts including stone implements of palaeolithic shapes. He obtained the assistance of Professor Andrew Young in determining the geological age of the deposits and of his colleague, Mr. A. J. H. Goodwin, in identifying the stone implements. Mr. Goodwin found the implements were assignable to two cultural ages—to the "Still Bay", so richly represented in Skildergat cave, and to the "Wilton" industry, also preserved in uppermost stratum of that cave.[2] Thus the question of the antiquity of the cranial fragments found by Professor Drennan was left an open problem.

Professor Drennan observed that most of the fragments were parts of a single skull, one of a remarkable kind.[3] His reconstruction is shown in fig. 44. The skull is long,

[1] *Illustrated London News*, September 5, 1925, p. 432.

[2] A. J. H. Goodwin, *Journ. Roy. Anthrop. Institute*, 1929, vol. 59, p. 429.

[3] Professor M. R. Drennan, "An Australoid Skull from the Cape Flats", *Journ. Roy. Anthrop. Institute*, 1929, vol. 59, p. 417.

191 mm., and narrow, 132 mm., the width being only 69 per cent. of the length. The roof, however, is low, rising only 107 mm. above the Frankfort plane. Now a low vault is suggestive of Bushman affinities, and amongst the cranial fragments found were some assignable to Bush skulls. The Cape Flats skull differs, however,

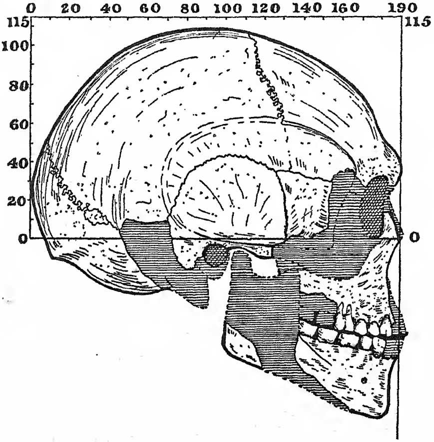


Fig. 44.—Profile of the Cape Flats skull oriented on the Frankfort plane. The parts shaded were missing. (Professor M. R. Drennan.)

from the Bushman type by the presence of Australoid features—the robust development of supra-orbital ridges and other cranial markings which characterize the skulls of male Australian aborigines. The face, too, is long, 123 mm., the symphysis rather deep, 33 mm., and the teeth large. The stature, inferred from the length of the thigh bone, was about 5 ft. 6 in. For these reasons and particularly because of the facial characters, Professor Drennan regarded the Cape Flats man as representative

of an Australoid type of South African, one of ancient but uncertain date.

Now it is not easy to determine, when we are confronted by such a skull as that from the Cape Flats, whether it represents an exceptional type of Bushman or a totally distinct race. Mr. F. W. Fitzsimmons has excavated a site in the Zuurberg, to the north of Port Elizabeth, where prehistoric Bushmen buried their dead. The deeper and older burials were of upper palaeolithic date (Smithfield B). The remains from these deeper graves have been described by a pupil of Professor Dart, Mr. L. H. Wells.[1] He found three types represented —a Bushman type, a large-brained Boskop type and an Australoid type. We may explain the presence of these types in a single community, as Mr. Wells has done, by supposing that they had been evolved elsewhere and came together and mingled in the Zuurberg. There is, however, another explanation—the types so discriminated may represent the extreme forms of a single racial stock, for in the purest human and anthropoid stocks known to us we find always a wide range of individual types.[2] Nevertheless, as we shall see in the following chapter, there is reason to believe that in palaeolithic times there was a southward drift in Africa of a people to which the Australoid type of the Cape Flats may be assigned.

[1] "Fossil Bushmen from the Zuurberg", *South African Journal of Science*, 1929, vol. 26, p. 806. Mr. Wells gives a full list of papers dealing with recent discoveries of human remains in South Africa. In his list will be found references to important papers on the past types of humanity in South Africa by Mr. H. S. Gear.

[2] Dr. Robert Broom has called attention to the Australoid features of the Koranna—a Hottentot people living in the Vaal River Valley, *Nature*, 1929, vol. 124, p. 507. In the author's opinion Hottentot and Bushmen have been evolved in South Africa from a common ancestry.

CHAPTER IX

SPRINGBOK MAN

SOME 80 miles to the north-east of Pretoria and occupying the centre of the Northern Transvaal there is a flat arid area, known as Springbok Flats. This upland, brown and dusty country, some 3,600 feet above sea-level, has an acreage equal to that of one of our smaller English counties, but nowadays it is so burnt-up with drought that it provides only the scantiest sustenance for living things. This was not always so; on its withered surface lie millions of stone arrow-heads and scrapers left by men who hunted over it; we may presume it was then green and well stocked with game.

The soil is curious; on the surface there is 1½ foot of reddish soil; under the soil comes a stratum of soft limestone—a tufa—which varies in thickness from 3 feet to 6. The limestone, Dr. A. W. Rogers tells us, has been formed under the soil from ground water which has percolated through basalt and thus become charged with lime. Under the stratum of limestone comes the bedrock of the country, a basalt. A stratum of soft limestone, such as underlies the soil of Springbok Flats, provides an excellent matrix for the preservation of bones.

Early in January 1929 workmen were digging a pit to obtain limestone for a new road which was being made across the flats. The greater part of a human skull was found embedded within the calcareous stratum; it lay 1½ foot within the stratum; over the limestone was 1½ foot of red soil. The skull thus lay only 3 feet beneath the surface of the soil. Captain Bishop Brown, who was in charge of the workmen, dispatched the skull fragments to the Transvaal Museum. The Curator of the Museum, Mr. C. J. Swierstra, having noted the fossilized condition of the bones, set out for the scene of the discovery, taking with him Mr. Herbert

Lang.[1] A search was made and enough was found to prove that a complete skeleton had been entombed where the skull was discovered. Not any bone was complete, but the shafts of the long bones—the thigh, leg and arm bones—were clearly those of a powerfully built man. A burial had certainly not been made from the present land surface; the upper margin of the limestone stratum in which the skull lay was intact; the bones were heavily mineralized; they were also marked by uncommon features. Yet, in my opinion, at some past time before the present land surface was formed, a burial had been made, for I cannot conceive any combination of natural circumstance which will entomb and at the same time leave all the parts of a dead human body in close proximity to each other. No stone weapon or ornament was found to give a clue to the date of burial; the limestone stratum of the flats has not as yet yielded any tools of ancient man. The bones of extinct animals, however, are found in it. Not far from the site at which the skull was discovered lay a limb bone—a metacarpal—of the extinct giant buffalo (*Bubalus bainii*). Although no human culture accompanies the remains of this extinct species in the calcareous stratum of the flats, yet, as Dr. Robert Broom has pointed out, it is otherwise in a deposit at Hagenstad in the Orange Free State. There the fossil remains of this buffalo are accompanied by a culture which corresponds to the early Aurignacian in Europe. In the same deposit at Hagenstad are found fossil remains of three other extinct species—two of them antelopes, the other being a horse of great size (*Equus capensis*). Thus indirectly we obtain some suggestion as to the probable antiquity of the Springbok skeleton, and if we apply the scale of time followed in this work, the antiquity of the Springbok skeleton should not be less than 15,000 years.

When the fossil remains of the Springbok man reached

[1] An account of the discovery of the Springbok skeleton will be found in the *Illustrated London News*, March 16, 1929, p. 426, and in *Nature*, March 16, 1929, p. 415.

Pretoria, Dr. Robert Broom arrived on a visit to the Museum, and the Director, Mr. Swierstra, wisely handed them over to him for reconstruction and description.[1] The skull was broken, but out of the fragments Dr. Broom was able to reconstruct its right aspect, although much of the left side and all the base were missing. Unfortunately too, the face was defective, there being nothing to indicate the nasal characters which are so important a clue to race. The more cancellous parts of the skeleton, including the ends of the long bones, had perished, but enough of the thigh bones was left to give a clue to their original length. Dr. Broom estimates that when intact they had a length of 500 mm., which indicates a stature of 5 ft. 10 in. at least. The shafts of the long bones are such as we meet with in strong muscular men. They are all of the modern type, except that the humerus shows certain unfamiliar characters. The ankle bone—astragalus—is massive but not peculiar in shape. There can be no mistake about the sex; the characters of the skull and limb bone are pronouncedly masculine.

In fig. 45 is reproduced in profile the skull of the Springbok man, taken from a life-size photograph published by Dr. Broom; the camera has distorted certain details in the foreground, but we may take the main representation as reliable. The skull is of large size; the brain-containing part, in fig. 45, is represented within a framework of lines which is 200 mm. long and 120 mm. high, being thus 10 mm. longer and 5 mm. higher than the one employed for the skull of a representative long-headed European. The vault of the skull is lofty; it rises 120 mm. above the Frankfort plane (F, F). It is long—195 mm.; it is wide, 144 mm.—the width being 74 per cent. of the length—a dolichocephalic skull. The cranial walls are not of great thickness—under 9 mm. The supra-orbital ridges are developed to the moderate extent often

[1] Dr. Broom's preliminary account of the remains was published in *Nature*, March 16, 1929, p. 415, and in the *Illustrated London News* of the same date, p. 426. The account given here is founded on the photographic illustrations which were reproduced in the *Illustrated London News* and the measurements from those published in *Nature*.

seen in black men as well as white. From these measurements we estimate that the cranial capacity—brain-volume—was about 1540 c.c., which is 200 c.c. above the mean for men of negro stock, 160 c.c. above the mean for men of ancient Egypt and 60 c.c. above the mean for modern Englishmen. Like so many members

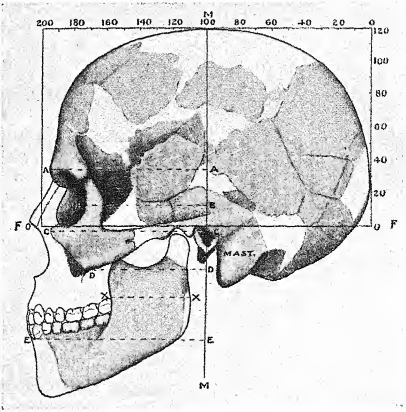


Fig. 45.—Profile of the Springbok skull as restored by Dr. Broom. It is set on the Frankfort plane (F, F) and enclosed within a frame which is 200 mm. long and 120 mm. high. The drawing of the skull has been reversed in order that the skull may be comparable to others depicted in this work. The parts found are shaded. Further explanation in the text.

of prehistoric races, Springbok man was large-brained, but it must be remembered that there are many black individuals now living in Africa, especially amongst Bantu peoples, who have brains quite as large as the Springbok man. Dr. Broom states that "the frontal bone is narrow, the width at the lower part being 106 mm.". This measurement probably refers to the transverse width taken at the level of the supra-orbital ridges. In

any case there is nothing in the contour of the skull nor in its measurements to distinguish it from that of the larger-brained Bantus of to-day.

The more we become involved in the identification of human races the more do we become convinced that we obtain more reliable assistance from the characters of the face than from those of the cranium. In the case of the Springbok man we have not the nose to assist us; all the nasal region of the face is missing. We have, however, three parts of the face to guide us (fig. 45): (1) the glabellar region of the forehead; (2) the cheek bone or malar, which completes the zygomatic arch; (3) the greater part of the lower jaw. Let us take the mandible first, as it displays the facial peculiarities of the individual with whom we have to deal. Dr. Broom has articulated the mandible to the skull as shown in fig. 45, with the tip of the coronoid process rising 5 mm. above the lower border of the cheek bone. This is probably a just relationship—the condition of parts when the mouth was shut. The total length of the face, measured from nasion to the lower border of the mandible at the symphysis, was about 132 mm.—a long face—14 mm. more than in the average negro, 15 mm. more than the mean for ancient Egyptians and 9 mm. more than for an average Englishman. There is no doubt that we are dealing with a characteristically long face to which the heavy lower jaw made a large contribution, for the symphysis has a depth of 39 mm. and a thickness (a front-to-back diameter) of 17·5 mm.—quite outstanding measurements. Clearly the upper face must also have been long; the distance from nasion to alveolar point could not well have been less than 80 mm. In the next chapter we shall deal with an equally long-faced people who lived in East Africa in prehistoric times.

For such a strong mandible the molar teeth are small; the total length of the three molars is only 30 mm. The front-to-back diameter of the lower dental palate as seen in true profile, the aspect depicted in fig. 45, could not have been more than 51 mm., which is the mean for

the dwarf Bushmen. The mean diameter for male negroes is 53 mm. And yet in spite of the relative smallness of the teeth, the sockets of the lower middle incisors—for a reason which will be explained in the next paragraph—stood uncommonly far in advance of the vertical auricular plane (fig. 45, M, M). The distance from the vertical auricular plane to the alveolar point of the lower jaw, measured as shown in fig. 45, E, E, is 105 mm., whereas in the modern negro the mean is only 95 mm. Further, it will be seen that in the plane represented in fig. 45 the chin of the Springbok skull is not prominent; it lies somewhat farther back than the sockets of the median lower incisors. A certain degree of prognathism was present.

The most remarkable feature of the Springbok mandible is its ascending branch or ramus which articulates with the base of the skull in front of the ear and gives attachment to the muscles of mastication. At its narrowest part the ascending ramus measures 46 mm. (see fig. 45, X, X), which is 14 mm. less than in the Heidelburg mandible, but 8 mm. more than the mean width for negro jaws. If we reconstruct the missing lower jaw of the Rhodesian skull, which can be done with some degree of accuracy, we must make its ascending ramus as wide as that of the Springbok mandible. Although the ordinary mandibular width among negroes is so much less than in Springbok man, yet there are to be seen in modern negro skulls mandibles which are just as massive as the Springbok example. In fig. 46 the profile of this fossil mandible is superimposed on that of a very tall negro (6 ft. 4 in.) who was born in the Cape Verde Islands off the coast of Senegal and whose skull is preserved in the museum of the Royal College of Surgeons, England. The dimensions and profile of this man's skull are very similar to the Springbok specimen. In shape and dimensions there is a close correspondence between the negro and Springbok mandibles (fig. 46). The ascending ramus of the negro mandible is 45 mm. wide—a millimetre less than in the fossil

specimen; its coronoid process is the more prominent (fig. 46, C, C′). Their lower borders and chin regions correspond. Both have the same depth of symphysis, 39 mm., but the negro symphysis is not quite so thick (16 mm.) and in the fossil jaw the areas on the lower border of the symphysis, for attachment of the digastric muscles, look more directly downwards than in the negro mandible—which must be accounted a primitive character. The real difference becomes manifest in their dental development; the teeth are so much larger in the

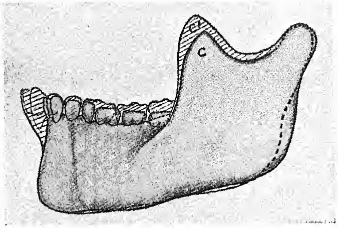


FIG. 46.—Profile of the Springbok mandible (C) superimposed on that of a negro (C′). In mending the Springbok jaw Dr. Broom omitted the space needed to carry the lateral incisor and canine of the right side. In figs. 45, 46 this omission has been made good.

negro that the median incisors lie 10 mm. in front of those in the Springbok mandible. This modern negro is more prognathous—more primitive—than the fossil African. Reduce the teeth of the negro in their dimensions, and an almost exact resemblance becomes apparent between the modern and ancient mandibles.

We shall deal briefly with other characters of the Springbok face. There is, in the first place, the malar or cheek bone; the shape and position of the malar help us in the identification of human races. The anterior angle of the malar lies in the lower border of the orbit. In primitive races this point is more distant from the verticular auricular plane than in cultured races. In the

Springbok skull (see fig. 45, C, C) the anterior angle of the malar lies 93 mm. in front of the auricular vertical (M, M), almost exactly the same distance as in the Cape Verde negro. These are exceptional distances; the mean for male negroes is 84 mm.; it was the same in the Ancient Egyptians. The mean distance in the face of the Englishman is 80·5 mm. On the other hand, the orbital margin of the malar (see fig. 45, B, B) was advanced only slightly more than in the average negro and Ancient Egyptian. The distance B–B was 73 mm. in the Springbok skull; 71 mm. in the average negro and Ancient Egyptian; the mean in Englishmen is 70 mm. Important, too, is the position of the lower or masseteric angle of the malar, situated at the lower end of the malo-maxillary suture (fig. 45, D, D). This angle marks the forward extent of the masseter muscle; the more advanced the greater is the development of the masseter muscle. The advancement of the lower malar angle is 73 mm. in the Springbok face, which is the mean for male negro skulls. In this measurement the Ancient Egyptian and Negro were almost alike. On the whole the characters of the Springbok malar are those which conform to a negroid type.

Lastly we have to deal with the glabellar region of the forehead which is moderately developed in the Springbok skull. The glabella—or glabellar point—in the Springbok skull lies 95 mm. in advance of the auricular vertical (see fig. 45, A, A), while the occipital point—the most distant point on the occiput—lies 100 mm. behind that plane. Thus in the Springbok skull, as is the case in most long-headed races of Africa, a greater proportion of the head lay behind than in front of the auricular vertical. A post-auricular dominance is not confined to African races, but is more common amongst them than in non-African long-headed races. In the forward position of its glabella the Springbok skull is in nowise singular.

The base of the Springbok skull is missing, but we can substitute a measurement which is closely correlated

with it—the radial distance of the centre point of the ear passage to the nasion at the root of the nose. In the Cape Verde skull, which has been mentioned several times, the radial distance from ear to nasion is 104 mm.; the length of the base of the skull measured from nasion to nasion is 108 mm.—4 mm. more. In the Springbok skull the radial distance of the nasion from the ear is 102 mm., so that the base must have been about 105 or 106 mm.—both measurements being above the means for negro skulls, as they should be when we consider the exceptional size of the Springbok brain.

In a former chapter we have discussed the facial triangle (see fig. 24, p. 96) and the method of estimating the degree of prognathism by comparing the lower side of this triangle (the auriculo-alveolar distance) with the upper side of the triangle (the auriculo-nasal distance). In the Cape Verde negro skull the auriculo-alveolar distance is 123 mm.—19 mm. more than the auriculo-nasal distance, an excess which indicates a high degree of prognathism. In the Springbok skull the lower side of the triangle measures 115 mm., against 102 mm. for the upper side. The lower side is 13 mm. more than the upper. The means for modern negroes are—96 mm. for the upper side—6 mm. less than in the Springbok skull, and 106 mm. for the lower side, against 116 mm. for the Springbok skull. In the negro the lower side of the triangle is 10 per cent. greater than the upper; in the Springbok the excess is 12·7 per cent.; in the Cape Verde skull 18 per cent. If we use these measurements as indications of prognathism—and with certain limitation we are justified in doing so—the prognathism in the Springbok man was greater than in the average negro. But as we have just seen from the case of the Cape Verde skull there are modern negroes who far exceed the prognathism of the Springbok man.

We have thus made a survey of the known features of the Springbok man. He was a tall strong fellow with a big brain, a long and wide head, a drawn-out face, great mandible and small teeth—a type which we cannot

fit into any African racial type known to us. He was cast in a mould altogether different from the Boskop and Fish Hoek men—big-brained and small-faced types. When I search for the Springbok type amongst the surviving peoples of the world, I find the nearest approach to it amongst peoples of North-East Africa—the Southern Somali—and other black-skinned races in adjoining territories who have a Hamitic type of countenance. Amongst the peoples who live on and near the south and south-western frontiers of Abyssinia, there do occur tall individuals, with long faces, and long prominent noses of medium width, and usually with heads which are narrow in comparison with their length—not counterparts of the Springbok type—and yet apparently akin to it. Nowhere outside Africa do I know of a similar type, either living or dead. My final conclusion is, then, that Springbok man represents a negroid or Hamitic type which made its way southwards in prehistoric times, probably carrying with him the Aurignacian culture of his time. I look on him as not distantly related to such Bantu-speaking peoples as the Matabele and Zulus. We have reasons for doubting if this type—the southern Bantu type—made its first appearance in South Africa only some thousand years ago.

It is possible that the Springbok people may have mixed with the indigenous stock of South Africa—represented by the types described in the preceding chapter—and that the Cape Flats man, reported by Professor Drennan, may be the issue of such a union. We must remember that of the multitude of races which have appeared on the South African stage during prehistoric times, we have succeeded as yet in finding only a few stray individuals.

CHAPTER X

ANCIENT MAN IN EAST AFRICA

IN the preceding chapter I promised to guide the reader to sites in Equatorial Africa where discoveries of prehistoric men, akin in type to Springbok man, had already been made. The district we are to visit is situated in Kenya Colony and represents a part of the great Rift Valley just south of the equator. In this particular section, less than 50 miles in length, are three small lakes, these being, taking them in their order from north to south, Nakuru, Elmenteita and Navaisha (fig. 47). They are upland lakes; the shallow waters of Lake Nakuru stand 5776 feet above the level of the sea at Mombasa—350 miles distant. The sides of the Rift Valley rise between 6000 and 7000 feet above the level of the lakes. They are landlocked; in ancient times their overflow had escaped northwards to reach Lake Baringo. There had been a time, and not so long ago, when the waters of the lakes stood some 800 feet above their present level, all three then being united to form one continuous sheet of water (fig. 47). We know that such had been the case because various observers, whose names will be mentioned presently, have noted remnants of the old beaches or shores formed when the waters stood 800 feet above their present level. Two other beaches can be traced round the Nakuru basin—one at about the 600-foot level and the other near the 300-foot zone.

At one time, then, Lake Nakuru had a depth of over 800 feet, and it stood at this level long enough to establish a permanent shore-line. Clearly that indicates a long cycle of wet years—a pluvial period. Then came the period when the lake stood at 600 feet, followed by a still later one at 300 feet. Kenya Colony is now in the arid phase of a climatic cycle; the lake has shrunk to small dimensions, leaving between its present shore-line and the encircling remnants of the 300-foot beach a wide plain which represents the floor of the old lake.

The three beaches do not represent arrested phases in a single act of subsidence; it is more probable that each indicate the high-water mark of separate pluvial periods, and that between these there occurred dry arid intervals in which the lake shrank to its present level or even dried up altogether. Thus, if the accepted interpretation is right, the Nakuru basin has in its circuit deposits which have been laid down at three periods of time—the one

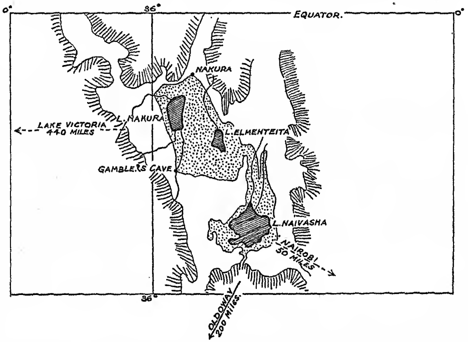


FIG. 47.—A sketch of the three lakes in the Rift Valley, Kenya Colony—Lakes Nakuru, Elmenteita and Navaisha. The present extent of the lakes is represented by shading; their prehistoric extent by stippling. (After Erik Nilsson.)

following the other. Is it possible that these pluvial periods correspond to the glacial periods of Europe? This, we shall find, is a possibility which is being discussed by several observers.

It is manifest that if men were living in the Nakuru basin in past times and visited the shores of the lake at its various levels some trace of them should be found in the old beaches. We should find stone implements dropped by accident or thrown away, remnants of their feasts, or perchance their buried dead. We must remember, too, the deposits laid down by flooded streams as

they debouched at the old shore lines. Such streams carried down from hill and plain carcases of dead animals or stray weapons lost by hunters and deposited them with their burdens of gravel, sand and mud in their estuaries. Now the merit of perceiving that the ordered deposits of this part of the Rift Valley were possible repositories of human history, and that the exploration of the old lake beaches was likely to throw new light on Man's past belongs to my young friend Mr. L. S. B. Leakey. He knew Kenya Colony in his boyhood, and when studying anthropology at Cambridge University under Dr. A. C. Haddon remembered the possibilities of the Rift Valley. After graduating in 1926 at the age of twenty-three, he succeeded in obtaining sufficient financial aid to permit him to lead a very modest expedition to the three Rift lakes. He returned to England in 1927 laden with an abundant archaeological harvest. Finding his evidence insufficient to prove some of his main theories, he again took the field in the autumn of 1928, returning to the Rift Valley as the chief of a group of youthful explorers—all of them enthusiastic volunteers. The account given here of the discoveries made by the "East African Archaeological Expedition" is founded on Mr. Leakey's published reports and also on personal communications, but this account in no wise forestalls the final report of the Expedition which will be given by its leader, Mr. Leakey. All I can hope to do here is to make plain to the reader the importance of the new field which he has opened up.

Mr. Leakey would be the first to admit that the trail he has followed was blazed by other pioneers. In 1893 the veteran geologist, Professor J. W. Gregory[1] visited the Rift Valley; he climbed Mt. Kenya and found that the present ice cap did not descend below 4000 m. but that at some former time it had been much more extensive. The edge of the ice cap—as indicated by old moraines—had extended 1000 m. lower than at present. He found the same evidence of former glaciations—wet

[1] *The Rift Valleys and Geology of East Africa*, 1895.

and cold periods—on the mountains of Equatorial Africa as had been observed on the Alps of Europe. More recently Dr. Erik Nilsson[1] has followed in Professor Gregory's footsteps and verified his observations; on all the high mountains of East Africa—Mt. Kenya, Mt. Elgon, Ruwenzori and Kilmanjaro—there is evidence of recent change in climate. Cold and wet periods have alternated with others which were dry and warm. The wet and cold periods were those which filled the lakes of the Rift Valleys; in the intervening periods they dried up. That East Africa had been inhabited by man from remote times is no new discovery. Surface tools, many of them representing the older cultures, had been gathered in many districts soon after the arrival of the first white residents.[2] Our knowledge of the geological deposits in which the older implements had been embedded, however, is of recent growth. In 1919 Mr. E. J. Wayland[3] became geologist to the Government of Uganda. He studied the pleistocene deposits of the protectorate and worked out the order of their formation. He searched them for traces of ancient man. In the older deposits he found crude implements of a pre-Chellean type; in later, implements which may be compared with the Mousterian culture of Europe; in more recent, stone implements with late palaeolithic affinities. In Uganda, then, Mr. Wayland has proved the existence of man from remote times, but the fortune of finding fossil remains of the men who shaped the palaeoliths was denied him. In Kenya Colony Mr. Leakey had better success. He and his companions discovered a very complete series of pleistocene deposits. They were able to associate with each deposit a definite phase of stone culture; they found

[1] "Preliminary Report on the Quaternary Geology of Mount Elgon and some parts of the Rift Valley", *Geolog. Föreningens i Stockholm Forhandlingear*, April, 1929.

[2] See *Eastern Uganda*, by C. W. Hobley, C.M.G., published by the Royal Anthropological Institute.

[3] "African Pluvial Periods and Prehistoric Man", *Man*, 1929, vol. 29, p. 118. See also "Implements of Rostrocarinate Type from Uganda", by J. Reid Moir, *Nature*, 1921, vol. 107, p. 649.

within these deposits an abundance of human remains—remains of the men who were concerned in the later phases of culture.

Before proceeding to give an account of the men unearthed by Mr. Leakey in the lake deposits at Nakuru, it is necessary that we should glance once again at a discovery of ancient man made in another part of the Rift Valley by Dr. Hans Reck of Berlin University, and first made public by him in 1914.[1] The Rift Valley as it passes southward crosses into Tanganyika territory (formerly German East Africa). Here it contains two considerable lakes—Natron and Eyanzi—the latter being 230 miles distant from Nakuru. The country which borders on these lakes is a parched scrubland, but there is the most ample evidence that this has not always been so. At the north-western end of Lake Eyanzi, in the Oldoway district, there are great deposits of past pluvial periods—of the same nature, but on a much greater scale, than those at Nakuru. The deposits contain much volcanic ash, and there are seams of calcareous sandy tufa which are so favourable for the preservation of fossil remains. Through these deposits at Oldoway a great gulley or gorge has been cut by a stream. On the sides of the gorge thus cut are exposed the edges of the seams and strata. To this gorge Dr. Hans Reck came in 1913 and found strata rich in fossil remains of a pleistocene fauna; he found teeth of an elephant allied to the Indian form—*Elephas antiquus recki*—and many other species of extinct mammalia. Animals still living in Africa were also represented in the deposits; half of the fauna discovered was that which still lives in East Africa. Towards the end of 1913 a human skeleton was exposed high up on the side of the gorge. It lay beneath 10 feet of intact strata; it was fossilized; it could not have been buried recently. The skeleton, that of a man, was complete; it lay on its right side with thighs flexed on the body and arms folded.[2] Dr. Reck inferred that the man

[1] See *Antiquity of Man*, vol. ii, p. 354.

[2] See photograph, *Illustrated London News*, April 4, 1914, p. 563.

had become immersed when Oldoway was a marsh or lake, and that subsequently 10 feet of sedimentary deposits had formed over his body. He also mentioned that the lower incisor teeth had been filed or chipped, as is still a custom amongst many African peoples. The posture of the body is exactly that which we find in deliberate burials; it is difficult to conceive a man's body assuming the crouched posture in the act of drowning. The Oldoway man was buried, but it certainly was not from the present land surface.

Dr. Reck has now described the nature of the deposits at Oldoway, the fossil remains embedded in them, and given an account of the circumstances which led up to the discovery of the human skeleton.[1] Having discovered human remains in the lake deposits of Nakuru during the season 1926–27, it became important for Mr. Leakey to know more concerning the precise characteristics of the Oldoway man. He visited Dr. Reck in Berlin and saw the skeleton; in state of fossilization its bones were similar to those of extinct species taken from the same geological horizon at Oldoway. Mr. Leakey assured himself that the Oldoway man was of the same type as he had found in the Rift Valley. The Oldoway man was tall, long and big-headed, with long narrow nose and elongated face. Further, Mr. Leakey could see no sign of filing or artificial shaping of the lower incisors.[2] With such evidence before me I had to revise the opinion I had formed in 1914 concerning the Oldoway skeleton. I had regarded it as an intrusive burial made in recent times from the side of the ravine. On the evidence now available we must accept Dr. Reck's opinion, namely, that the Oldoway man was living before one or more pluvial periods had covered his resting-place with strata some 10 feet in depth. He was buried, but not from the present land surface.

[1] *Mitteilungen aus den Deutschen Schuzgebieten,* "Praehistorische Grab und Menschenfunde und ihre Beziehungen zur Pluvial-Zeit in Ostafrika", Berlin, 1926, vol. 34, p. 50.

[2] "The Oldoway Skull", *Nature,* 1928, vol. 121, p. 499.

In 1929 Professor Th. Mollison and Dr. W. Giesler of Munich published a preliminary account of the Oldoway man.[1] He was tall, over 1·800 metres (5 ft. 10½ in.), long-legged, with very long head (203 mm.), which was narrow (133 mm.). The cranial vault was evenly arched, of medium height, its highest point rising 115 mm. above the Frankfort plane. The face had strongly marked features and was particularly long, measuring from root of nose to lower border of chin 132 mm. Especially noticeable was the contribution made to the length of the face by its maxillary parts; from the lower border of the nasal opening to the lower border of the chin measures 81 mm., owing to the high arch of the palate and massiveness of the chin and lower jaw. The face is such as we still meet with among tall members of the Hamitic races of North-Eastern Africa. In the opinion of the Munich anthropologists the Oldoway man represents an ancient Hamitic type. The nose was 51 mm. long, 26 mm. wide and as prominent as in many Europeans.

Oldoway in Tanganyika Territory is 1600 miles distant from Springbok Flats in the Northern Transvaal, yet there are many points of similarity to link the discovery made in the one place to that made in the other. In both cases I presume we have to do with burials; in neither the Oldoway nor in the Springbok grave was any artefact found to give a clue to the date of burial. In both cases the skeletons lay in strata containing the fossilized bones of extinct species of mammals, and the human and animal bones were mineralized to the same degree. In both cases the men discovered were of a similar type—tall, powerful, long-headed, long-faced, long-nosed. To explain these similarities we must presume a migration in Africa at some remote period. As to the period and the direction of the migration we must now appeal to Mr. Leakey.

On the three chief sites at which Mr. Leakey dis-

[1] "Untersuchungen über den Oldoway Fund", *Verhand. Gesell. für Physische. Anthrop.*, 1929, vol. 3, p 50.

covered human remains, one is situated at the northern end of the Nakuru basin, below the railway station of the same name; the other two, some 15 miles distant, are situated at the southern or Elmenteita end of the valley (fig. 47). The deposits at the Nakuru site rest against a cliff-like escarpment which faces the lake. They are 13 feet in depth and rest on the lowest of the old beaches, one which is here 365 feet above the present level of the lake. These deposits, then, are later than the last pluvial period which led to the formation of the beach. At various levels in the deposits of the Nakuru site Mr. Leakey found human remains representing at least ten burials; we cannot doubt that these represent deliberate interments. One skeleton, that of a man, was almost complete. He had been laid to rest on his side, in the crouched position; stones had been placed near the head to protect it; scores of chipped obsidian flakes lay in the grave. At all levels of the deposits were found an abundance of "pygmy" implements of obsidian—a "microlithic industry"—also pieces of decorated pottery, stone bowls, and mortars and beads. Such accompaniments indicate that this Nakuru people practised agriculture, and may have been a community living at Nakuru when the waters of the lake still stood high enough to reach the old beach. In the beach itself Mr. Leakey recovered "obsidian-backed blades"—indications that people practising a still older stone culture frequented the shores of the lake when the beach was being laid down.

The skull of the man found in grave 9 of the Nakuru deposits is remarkable in several ways.[1] It is 189 mm. long, 132 mm. wide—the width being scarcely 70 per cent. of the length. In brain size this man was in no wise exceptional, his cranial capacity being 1450 c.c. The vault of the skull was not high, rising only 113 mm. above the ear passages. Its outstanding characters lie in the face, which is long, the total length from nasion to chin being 136 mm., the upper face 80 mm., both exceptional dimensions. The great length of the face,

[1] Mr. Leakey has published measurements in *Nature*, July 16, 1927, p. 85.

however, is not due to an elongation of the nose—the nasal height is only 51 mm.—but, as in the Oldoway skull, to that part which lies between the floor of the nose and the lower border of the chin which measures 85 mm.—due to the depth of upper and lower jaws. The depth of the lower jaw at the symphysis is 38 mm. The bizygomatic width is great, 140 mm., and yet, save for this, the face is narrow. At its narrowest part the ascending ramus of the lower jaw measures 37 mm., against 46 mm. in the corresponding measurement of the Springbok mandible and 42 mm. in the Oldoway specimen. The nose was relatively wide; on the skull the nasal width is 26 mm. The face, seen in profile, cannot be described as having a projecting snout; it is not prognathous. It certainly is not the skull of a pure negro; its points of resemblance to the Oldoway and Springbok skulls are numerous and manifest. One other point worthy of mention is the great height of the vault of the palate; it stands 29 mm. above the grinding level of the upper molar teeth. A high palatal vault is one of the characteristics of the Rhodesian skull.

The second site (Elmenteita I) at which Mr. Leakey discovered human remains is at the 393-foot level towards the southern end of the Nakuru basin. Here again there is a cliff shelter overhanging a ravine or valley cut by a stream. There is evidence in the deposits of the valley that this level of the basin has been twice submerged, the valley having been twice excavated and twice refilled. The crevices of the rock near the cliff shelter were filled with remnants of material belonging to the later submergence. On exploring these pockets of alluvium Mr. Leakey discovered scattered human remains, representing at least twenty-six individuals. Plainly the original burials had been disturbed, for I presume that burials had been made under the rock shelter at some past time. Such a number indicates that a community, living a more or less settled existence, had made its home at or near the rock shelter. This inference is borne out by the discovery of fragments of

pottery, a stone bowl or mortar, and of implements worked in obsidian, in the alluvial pockets. The implements represent an older culture than that which prevailed at Nakuru; Mr. Leakey regards the Elmenteitan as the equivalent of the Magdalenian of Europe (see fig. 162, p. 464). In the alluvial pockets were also found

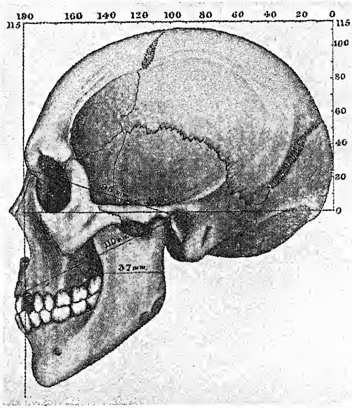


FIG. 48.—Profile of an Elmenteita man (A) oriented on the Frankfort plane and set within a frame 190 mm. long and 115 mm. high.

fossilized animal bones representing species which no longer live in the district.

Now, amongst the remains found at this site (Elmenteita I) there were two human skulls nearly complete—both of men. One resembles closely the Nakuru skull; it is a little longer and a little narrower, and its cranial capacity is a little higher, 1480 c.c. (fig. 48). There is the same long face (133 mm.), deep symphysis (41 mm.), but in this case the nasal part of the face is also elongated—the nasal height being 59 mm., the nasal width 28 mm.

—a wide nose (fig. 49). In the Nakuru skull the nose was short, the palate deep; in the Elmenteita skull the nose is long and the palate of moderate depth, 21 mm. The other man's skull found at Elmenteita differs from his fellow in several respects. He was large headed; in length his skull measured 200 mm.; in width 152 mm.—both

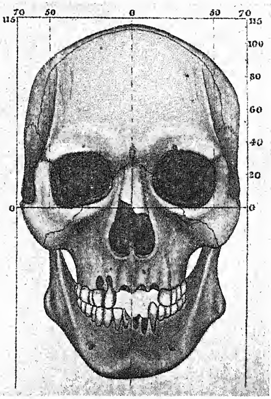


FIG. 49.—Full-face view of the skull (Elmenteita A) shown in fig. 48, oriented on the same plane.

being excessive dimensions. The width was 76 per cent. of the length; he was less dolichocephalic than his neighbour. The vault of the skull was lofty, rising 119 mm. above the ear passages; his brain was large, as indicated by a cranial capacity of 1680 c.c. That he was of the same breed as the other we infer from his facial characters. The lower jaw is missing, so we can measure only his upper face; its length was 83 mm. His nose was proportionately long, 60 mm., but in this case it was narrow—only 24 mm. His cheeks were prominent,

as shown by a bizygomatic width of 145 mm. The greater size of this man's skull does not signify that he was of a different breed; in the purest of human races individuals occur with heads of exceptional size, as well as others of a very low cranial capacity.

In the Elmenteita skull (fig. 48) we notice that, as in the Springbok and Oldoway skulls, a great extension behind the ears. The shortness of the preauricular part of the skull shown in fig. 48 is brought out by the length of the radius which joins the centre of the ear to the nasion. It measures only 95 mm., against 110 mm., the length of the radius to the alveolar point (fig. 48). Thus there is a degree of prognathism comparable to that of the Springbok skull.

The most important site (Elmenteita II) excavated by Mr. Leakey is also situated in the southern end of the Nakuru basin, 594 feet above the present level of the lake and therefore just below the position of the old 600-foot beach. Here rises up an overhanging cliff which forms a shelter or cave, known as Gamble's cave. The deposits in the cave form a wonderful series (fig. 50); before reaching rock bottom at a depth of 24 feet, Mr. Leakey had to dig through fourteen distinct strata, each of them marking a phase in the history of the cave. To find comparable examples we have to visit the Grotte des Enfants[1] in the South of France or Tzitzikama[2] in the south of Cape Colony. In the French cave there were 33 feet of stratified deposits; they began in the Mousterian period and ended with the Aurignacian; there were twelve levels of occupation. In the South African cave the stratified deposits measured 31 feet in depth; there were at least four levels of human habitation.

More instructive still are the records of the Bambata cave in Rhodesia (see p. 130). In the deepest stratum of that cave were Acheulean tools—a culture represented, not in Gamble's cave, but found in the oldest pleistocene deposits of the Rift Valley. Over the Acheulean, in the Bambata cave, came alternating strata of Mousterian

[1] See *Antiquity of Man*, vol. i, p. 96. [2] *Ibid.*, vol. i, p. 372

and Aurignacian (Capsian), these cultures fusing in the upper strata and thus ending in the "Still Bay" industry

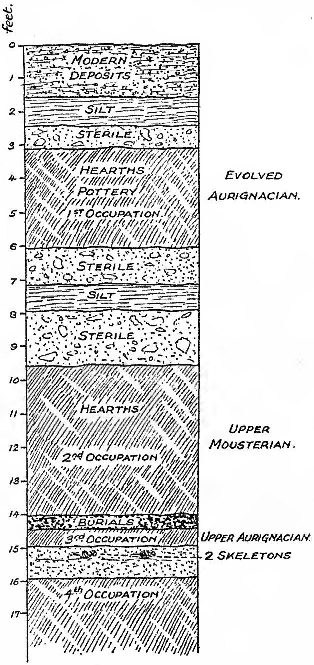


FIG. 50.—A diagrammatic sketch of the strata found in Gamble's cave, Elmenteita. Adapted from Mr. Leakey's records.

(p. 131). To this sequence of industries, that found by Mr. Leakey in Gamble's cave has resemblances; in the 3rd occupation stratum (fig. 50), he found an Aurignacian

industry (Upper Aurignacian of Kenya), followed by a Mousterian industry (Upper Kenyan). In the upper and later strata the industries were apparently combined, the resultant being one comparable to "Still Bay". Thus we may suppose that the upper strata of Gamble's cave are as old as those of the Skildergat cave in which the remains of Fish Hoek man were found. The deeper strata of Gamble's cave are as old as or even older than, so Mr. Leakey infers, the cave strata in France which contain the remains of Cromagnon man.

In Gamble's cave Mr. Leakey found four levels of occupation marked by the presence of hearths, implements and animal bones (fig. 50). The upper hearth-level occurred under three distinct strata; no burials were found at this the first level of occupation. The obsidian implements and pottery found in the upper occupation level were similar to those found at site 1. Then at a depth of 12 feet the second occupation level was reached, three barren strata intervening between this and the first level. At this, the second level, the obsidian implements were of an altogether different type—indicative of the Mousterian culture; the animal remains showed that the people at this level consumed game of another kind. There was no pottery.

Mr. Leakey reached the second occupation level at the end of his first season, 1927. When he resumed in 1928 he expected, if human remains occurred, that they would not be of the modern or neanthropic kind, but of another and older type, for in Europe the human remains associated with the Mousterian culture are always of the Neanderthal type. On resuming he found under the second level, and separated from it by only a thin barren stratum, a third occupation level (fig. 50). In the upper zone of the third occupation level he found three burials—one of them being an almost complete skeleton which had been placed in the crouched position—as at Nakuru and Oldoway—and buried on its side. The men thus found were not of a strange or Neanderthal type. Only fragments of these upper burials in

the third occupation layer could be preserved. Further, he was surprised to observe that the stone culture in the third level was Aurignacian in character—not Mousterian as in the second. Such a reversion in sequence had never been observed in Europe; there the Aurignacian culture succeeds, never precedes the Mousterian. Just above bed-rock, at a depth of 24 feet, there was a fourth and older occupation level. Here a most surprising discovery was made; fragments of pottery were found.

Under the third occupation level of Gamble's cave (fig. 50), Mr. Leakey discovered two more burials, both bodies lying on their sides in a crouched posture. One skeleton was that of a man, almost a duplicate of the Oldoway man. Mr. Leakey succeeded in detaching and raising the stratum in which this skeleton was embedded and in transporting the whole mass to England. The ends of the long bones, although crumbling into dust, can still be clearly discerned in the earth of the stratum and their total length can therefore be measured. The Gamble's cave man like the Oldoway man was tall, about 5 ft. 10 in. or 5 ft. 11 in. (over 1·800 m.). His femur measured 487 mm. and his tibia 432 mm., the length of the tibia being over 88 per cent. of that of the femur—a ratio which prevails in the tall peoples of the Upper Nile, both negro and Hamite. The skull has only been partly freed from the earth, but its length is almost the same as that of the Oldoway skull—just over 200 mm.—while its width is somewhat greater, viz. about 138 mm. The height and arching of the skull are alike in both; in both the post-auricular part of the skull is long; in both the face is drawn out, measuring over 130 mm. in length; in both the symphysis of the lower jaw is deep and the chin pronounced. In the Gamble's cave skull the forehead is dombed and wonderfully smooth, the supra-orbital ridges being less marked than in the Oldoway and Elmenteita skulls.

It was most fortunate that the second skeleton discovered under the third occupation level of Gamble's cave (fig. 50) was that of a woman, for we must take

both sexes into consideration when determining the characters of a race or type. With Mr. Leakey's permission I reproduce here a profile of the woman's skull. It is a large skull for a woman—190 mm. long and 144 mm. wide, the width being almost 76 per cent. of

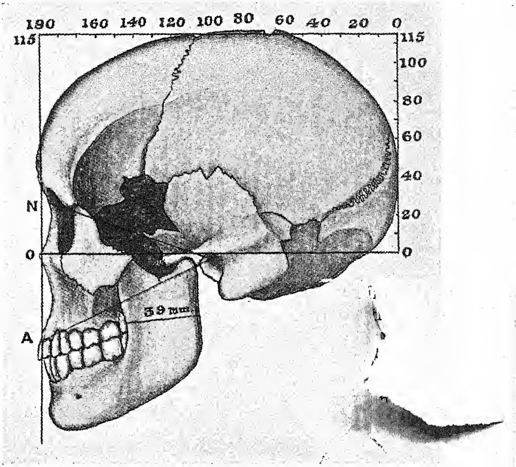


FIG. 51.—The skull of the woman found under the third occupation level of Gamble's cave. It is oriented on the Frankfort plane.

the length. The vault is relatively high, rising 115 mm. above the Frankfort plane. The face is 115 mm. long and 130 mm. wide at the zygomatic arches. The distance from ear to nasion is relatively short—90 mm., while that to the alveolar point is 98 mm.—8 mm. more (fig. 51). The negroid or Hamitic features are more apparent in the woman than in the man. Thus we have evidence that the tall Cromagnon people of France had equally

tall contemporaries in East Africa. It would take us too far afield to compare these ancient European and African types. I look on the Oldoway type—to which I would assign Elmenteitan man, Gamble's cave man and Springbok man—as a proto-Hamite, just as I look on Cromagnon man as a proto-European.

How long ago is it since Gamble's cave was inhabited? Did those long-faced fellows live in Gamble's cave when the tall Cromagnons occupied the Grotte des Enfants on the coast of the Mediterranean? Were the stone cultures of the Rift Valley contemporary with corresponding palaeolithic cultures of Europe? Do the ice periods of Europe correspond in time to the pluvial periods of Equatorial Africa? Mr. Leakey is convinced that there is a correspondence and has formulated a provisional scheme in which the sequence of pluvial deposits of the Rift Valley and their contained stone implements are compared with the glacial deposits of Europe and their palaeolithic industries.[1] The part of his scheme which has an immediate interest for us here bears on the age of Gamble's cave. In Mr. Leakey's scheme human habitation began in this cave about the same time as in the Grotte des Enfants. In the French cave habitation had begun before the last great glaciation of Europe took place; the fauna and flora were then those of a warm climate; the culture was Mousterian. Habitation continued throughout the last great glaciation, the culture being Aurignacian. In Gamble's cave, Mr. Leakey found evidence of men living there before the last great pluvial period and of repeated occupation throughout the whole length of the period. He finds evidence of the contemporary existence of Mousterian and Aurignacian cultures and traces their alternating development from the lower to the upper strata of Gamble's cave. The human remains so far found are those of modern or neanthropic man. In Europe the last great (Würm) glaciation was followed by a minor

[1] *Nature*, 1929, vol. 124, p. 9. See also Mr. Wayland's scheme: *Man*, 1929, vol. 29, p. 118.

recurrence—the Buhl glaciation—the period of the Magdalenian culture—which in the modest scale of reckoning followed in this work is given an antiquity of 12,000 years. In Mr. Leakey's scheme the uppermost level of human habitation in Gamble's cave, and also the deposits at Elmenteita (site I), are made to correspond in time to the period of Magdalenian culture in Europe. Now at the Elmenteitan sites were discovered pottery and stone bowls—evidence, I think, that the ancient occupants of these 'floors' were already agriculturalists.[1] The Nakuran site is later; it is post-pluvial. Now if Mr. Leakey's scheme is well founded, if he has construed his geological and cultural evidence aright, then the men living in the ancient well-watered upland valleys of East Africa were many thousand years ahead —in a cultural sense—of their contemporaries in Europe.

Mr. Leakey is prepared to believe that this was so. He accepts the theory which regards that part of Africa which is covered by the sands of the Sahara[2] as the evolutionary cradle, not only of the modern or neanthropic type, but also of that type of stone and bone culture to which the name "Aurignacian" has been given. Certainly there is every reason to think that the northern zones of Africa were well watered when the northern zones of Europe were ice-bound. If we suppose the Sahara to have been the original home of the neanthropic race or type, then it becomes conceivable that, when its representatives spread abroad, they might have reached Equatorial Africa long before they crossed the Mediterranean to settle in Europe or have migrated eastwards into Asia. The Saharan theory fits well into Mr. Leakey's scheme for ancient Kenya.

All of us approach such issues as are now being raised by Mr. Leakey with certain biases and preferences. We are all seeking for an explanation of what we know—or what we think we know—concerning the processes and conditions, the times and places which have brought the

[1] Mr. Leakey is convinced that the art of pottery is much older than that of agriculture.

[2] See *Antiquity of Man*, vol. i, p. 38.

earth and its human population into their present state. We have to account for the divergence of neanthropic man into races and for the geographical distribution of these races in past times.[1] We have to presume that Africa south of the Sahara is the evolutionary homeland of the negro and of the Bushman. All the evidence available indicates that the distribution of the negro type was much more extensive than it now is. The men discovered by Mr. Leakey are certainly not negroes, but to my eye they are certainly negroids or Hamites. One particular prejudice stands between me and a ready acceptance of the antiquity ascribed by Mr. Leakey to the stone cultures of East Africa. In our brief experience of the world we have never found that negro or negroid peoples are gifted with inventiveness or have ever manifested a strong desire to improve their material culture. This may not have been the case in earlier stages of their evolution. Believing, however, that heredity is true, I have difficulty in even supposing that the native peoples of Africa were ever pioneers in advancing the cultures of the world. And yet, as I write, the big-brained Boskopoids of South Africa raise a warning finger!

Another line of reasoning makes me hesitate to accept the scale of dates which Mr. Leakey proposes to give to the ancient cultures of East Africa—particularly those discovered at Nakuru and in the later sites at Elmenteita. The really important event in the later history of mankind is the discovery of agriculture, and of its attendant industry—that of the potter. Which was the country, who were the men, when was the time, that saw the first rude beginnings of sowing and reaping of grain and of the taming and breeding of cattle? As the evidence stands, we cannot suppose that Europe and Europeans were concerned in this discovery, nor Africa and Africans, nor Mongolia and Mongolians. As the explorer's spade digs more deeply into the past, the belief grows that our modern civilization, which was made possible by

[1] See Keith, "The Evolution of Human Races", *Journ. Roy. Anthrop. Institute* 1928, vol. 58, p. 305.

the discovery of agriculture, was born in the south-western part of Asia—between the Black Sea and the Indian Ocean—and that the pioneers in this critical movement were neither black, yellow nor white, but brown folk whose representatives still survive in the population of Arabia. The more we come to know, the more remote do the beginnings of agriculture seem to be; we must give it an antiquity of some 10,000 or 12,000 years to explain all that we know. It is certain that a knowledge of agriculture was carried into Egypt at a very early date—certainly 5000 years before the Christian era began. It is possible—nay probable—that a knowledge of its rude beginnings may have spread up the Nile and reached Equatorial Africa before it had spread westwards into Europe. But even if we admit this it is difficult to suppose that culture in the Rift Valley was moving ahead of that of predynastic Egypt. Mr. Leakey has made discoveries of the highest importance, but to bring some of them into the picture of prehistory as I see it, they have to be refocused.

CHAPTER XI

THE DISCOVERY OF THE GALILEE SKULL

We began our survey of recent discoveries of fossil man in one of the great cul-de-sacs of the world—South Africa. Through the preceding ten chapters we have worked our way northwards to Equatorial Africa, finishing with the remarkable discoveries which Mr. Leakey is now making in Kenya Colony. Mr. Leakey believes that the prehistoric people of this part of Africa were more white than black, whereas I am of opinion that the opposite was the case—they were more black than white. This difference in opinion it will be well to bear in mind as we move into another part of the world. In this chapter we are to take up our search in Palestine, thus passing from Africa to Asia, and as I am convinced that we must, when interpreting the racial character of prehistoric remains, take into account the present distribution of human types, it will be well for us to note the kind of peoples which now occupy the lands which have to be traversed in passing from Kenya Colony to the Holy Land. Two routes are open to us; we may proceed by way of the Nile and Egypt, or we may cross at the Straits of Bab-el-Mandeb, and make northwards through Arabia. The journey, if we proceed by air, is about the same in either case—namely, 2500 miles. If we take the Nile route, then the first thousand miles, which takes us as far as Khartoum, carries us over regions inhabited by peoples which are predominantly negro in type. When we pass Khartoum and enter the stage of our journey which brings us to Cairo—a good thousand miles—the type begins to change; nowhere in the thread of humanity which unites the population of the Sudan to that of the Delta of the Nile is there a break or sudden change from black to brown or from brown to white. In Lower Egypt we are among a people in which Mediterranean features become dominant. In recent as in past times, there has been a free invasion of Egypt by Arab,

Turk, Greek and other inhabitants of neighbouring lands, but nothwithstanding such admixtures, those who are practised in identification of living human types have no difficulty in distinguishing the true native of Egypt from all other representations of the Mediterranean type. The Egyptians are the least European and the most African in their physical features of all the peoples of the Mediterranean basin. When we leave Egypt and make the last stage of our journey—one of 250 miles—which takes us to the centre of Palestine, we find we have entered the homeland of another human type. It is just because Palestine is an outpost of Asia, one situated near the threshold of Africa, and because it has been inhabited since earliest historic times by a highly specialized type of humanity, that its exploration by the spade seems so full of promise. Western Europe and South Africa are cul-de-sacs, but Palestine is near the hub of the universe of humanity.

In place of approaching Palestine by way of Egypt, it will repay us to retrace our steps to Kenya and take the Arabian route northwards. One thousand miles in a north-easterly direction and we are across the straits of Bab-el-Mandeb and within the great Arabian peninsula. Although to reach Palestine involves a further flight of 1500 miles, we are already in the area of Palestinian distribution; the native of the desert is of the same type as we shall meet with in the north—be his head round or long. No doubt there has been, since the most remote times, a free traffic between Africa and Arabia at the southern end of the Red Sea; in Abyssinia we can see, I think, most definite evidence of a mixing of African with Arabian blood. It is not by hybridization, however, that we can explain the changes which affect the features of the population as we pass from Kenya to Arabia. In the peoples we meet with in this part of our journey the skin remains deeply pigmented, and the hair, if not woolly, is frizzled; the facial features become non-negroid, the nose narrow and straight, the cheeks subside; the lips become thinner, as is seen in the Somali type. Then at

the Red Sea there is a break and we enter the present domain of the Caucasian, the type which now extends from Ireland to the gates of India. We have to make the circuit of lands which bound the Arabian Sea to the north—Arabia itself, Persia, Baluchistan, Afghanistan—and pass well within India before we encounter a dark-skinned type, which has all the appearance of being first cousin to the Somali type of Africa. To account for this breach in the black line which extends from Africa to Melanesia, we must suppose that there has been, at some remote period, an eruption southwards of the Caucasian type. We have to remember how extensive a land Arabia is; it is equal to half of Europe. There is evidence that it was once well watered and thickly populated. We may proceed on the assumption, justified by students of meteorology, that the rain belt spread southwards as arctic conditions developed in the north. When northern lands were frozen over Arabia provided a desirable home for men. As a working hypothesis, we may presume that the southward extension of the Caucasian type took place during the last glacial period, which on the scale of reckoning used in this work, takes us back some 15,000 or 20,000 years. Whether this was so or not can be settled only by exploration of sites within the peninsula. Since Palestine lies on the margin of the area, the prehistorian turns to it in the hope that it will be to him as it was to the Hebrew of old—a land of promise, and will provide a clue to the many secrets of man's past which now lie hid in the sandy wastes of Arabia.

So large does Palestine loom in our youthful imagination that it is almost with a shock of surprise that we discover its actual size. The essential Palestine is a narrow strip of land lying between the eastern end of the Mediterranean and the Jordan Valley. From "Dan to Beersheba" is only 143 miles; the average width is only 40 miles; its area is comparable to that of Wales. Like Wales it is a mountainous land, but its hills and uplands are fashioned out of limestone—just the material

to provide cave man with natural habitations and prehistorians with a harvest of facts. No part of the ancient East has been more ardently studied than the "land of the Bible", but down to 1925 archaeologists had not turned their eyes to the hills; the light they were in search of lay buried in the sites of ancient cities. Yet they were quite aware that Palestine had been a home of prehistoric man; implements representing the palaeolithic cultures of Europe had been gathered as "surface-finds". In the limestone formations to the north of Palestine—in Mount Lebanon and behind Beirut—caves had been explored, and had yielded palaeolithic implements and remains of animals which no longer live in these lands. Such clues could not be followed up until after the Great War. A more settled government then provided bands of archaeologists, equipped by learned societies in Europe and America, with such conditions as they never enjoyed before. Amongst the many voluntary enterprises which devoted its energies to the exploration of biblical sites, none deserves more honourable mention than the British School of Archaeology in Jerusalem.

In the spring of 1925 Professor John Garstang, then Director of the British School of Archaeology in Jerusalem, was joined by a young recruit of great promise, Mr. F. Turville-Petre, who had studied anthropology in the University of Oxford. With Professor Garstang's acquiescence Mr. Turville-Petre resolved to devote himself to an exploration of prehistoric sites. Leaving Jerusalem, he turned his face towards the north. After a journey of some 70 miles, he reached the shores of the Sea of Galilee. Then, having made a preliminary survey, certain caves on the farther (north-western) shore were chosen for excavation. The extent of the Sea of Galilee is not in keeping with the greatness of the historic scenes which have been enacted on it and around it. Its greatest length, from north to south, is only 12 miles; its greatest width, from east to west, only 8 miles. All round it the limestone hills come down to the water's

edge, save at the north-western end where the plain of Gennesaret separates the shore from the foothills of Northern Galilee. The plain of Gennesaret is a fertile but small stretch of land, tilled by Jewish settlers; it is some 3 miles in length but only 1½ miles in width. A stream issues from a ravine or gorge in the

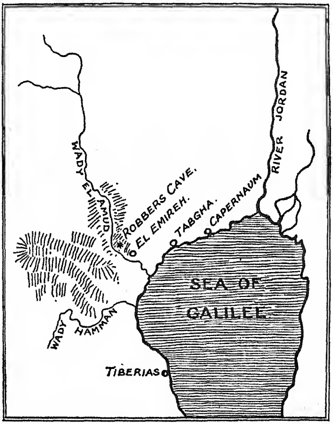


FIG. 52.—A sketch of the northern end of the Sea of Galilee showing the sites of the caves explored by Mr. Turville-Petre. The Galilee skull was found in the Robbers' cave.

hills—the Wady-el-Amud—and crosses the plain to reach the sea (fig. 52). Just after the stream has issued from its ravine a bluff of limestone rises from the plain. In the southern aspect of this bluff are three small caves —known as the Mugharet el Emireh—which were first explored and certain discoveries made, but meantime it is better for us to follow the stream into the ravine; less than 200 paces take us to the chief scene of Mr. Turville-Petre's explorations. Reaching this point,

the explorer saw the opening of a large cave; it was situated high up on the northern side of the ravine—on his right hand as he faced upstream. Scrambling up from the stream he reached a platform or terrace in front of the cave; it was situated 130 feet (40 metres) above the bed of the stream. The cave itself opened on the face of a limestone cliff, some 65 feet high (20 metres), which crowned the site of the ravine. The mouth of the cave faced the south-west, just the aspect which tempted cave man, who could also rely on having a certain water-supply in the stream below. Whatever purpose it may

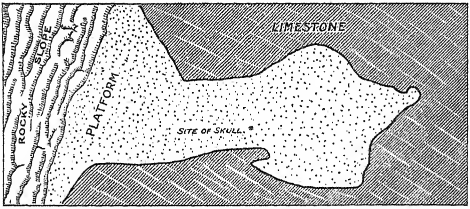


Fig. 53.—Ground plan showing the dimensions of the floor of the Robbers' cave. The position of the skull is indicated by X.

have served in prehistoric times, Mr. Turville-Petre found that the Mugharet-el-Zuttiyeh—the "cave of the Robbers"—was then used, and had been so used for a long time, as a stable or shelter for goats. The reader will see from the ground plan (fig. 53) that the cave was sufficiently extensive to accommodate a large flock of goats. The floor of the cave measured 62 feet from its entrance to its hinder wall; its width at the entrance was 40 feet; farther back it became wider—60 feet. Its roof was lofty—nearly 32 feet at the entrance and 39 feet within. The platform or terrace extended about 36 feet in front of the cave before it shelved down abruptly into the side of the ravine.

Having obtained possession of the cave the explorer

resolved to dig a trench through the strata of the floor, right from the shelving edge of the platform to the farthest recess of the cave floor. The strata laid bare in this long trench are shown diagrammatically in Fig. 54. The uppermost stratum, composed of a dark brown earth, contained a succession of hearths with definite evidence that during the formation of this stratum the cave had been inhabited (1) in the early bronze period, (2) in the early iron period, (3) in the Byzantine period. The bones

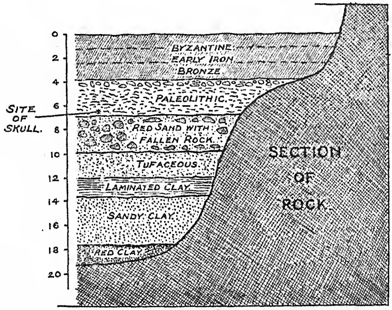


Fig. 54.—A diagrammatic section of the strata exposed in the floor of the deepest part of the Robbers' cave. (After plans made by Mrs. Baynes.)

found in the upper stratum, which had an average thickness of nearly 4 feet (1·2 metre), were soft and crumbled when handled. Under the upper stratum came the second, altogether different in nature and in antiquity. It was made up of a fine, dry, reddish earth, its average thickness being just under 3 feet (0·9 metre). During the formation of this stratum pieces of rock had become detached from the roof, scattered blocks were found throughout. At the close of the formation of the second or palaeolithic stratum fragments still continued to fall, so as to form almost a pavement between the first and second strata (fig. 54). Besides the detached fragments

of rock the second or palaeolithic stratum contained masses of consolidated breccia; in these masses were embedded flint implements and charcoal; the men who inhabited the cave during the deposition of the second stratum knew the uses of fire. Mr. Turville-Petre regarded the conglomerate masses as marking the sites of hearths. The flint implements, which were extremely abundant, provided the excavator with definite evidence as to the antiquity of the second or palaeolithic stratum. The implements were shaped in the manner practised by the men who occupied the Le Moustier cave in France before and during the last period of glaciation; small hand-axes (*coups de poing*) were numerous, side scrapers showed the characteristic Mousterian technique, triangular "points" so prevalent in the earlier cave deposits of Europe were especially frequent. Trimmed flakes and blades were plentiful.[1]

The men who occupied the Robbers' cave during the formation of the second or palaeolithic stratum were hunters; animal bones, purposely broken, some of them bearing the marks of crude tools—hacks and cuts—were scattered plentifully throughout the deposit—particularly in its deepest or oldest parts. The bones were heavily mineralized; they rang like porcelain when struck. Thanks to the labours of Miss Dorothea Bate,[2] we know the kinds of animals which then lived in Galilee and were hunted by the cave men. They included the two-horned rhinoceros (*Rhinoceros hemitoechus*)—alleged to be the unicorn of biblical writers, the hippopotamus (Behemoth), the brown bear (*Ursus arctos*), a primitive species of pig, porcupine, a species of red deer (*Cervus elephas*), fallow deer (*Dama mesopotamica*), ox, horse, gazelle, camel, etc. Altogether Miss Bate recognized twenty-two species of mammals amongst the fossil remains dug from the palaeolithic stratum of the Robbers' cave. Such a fauna indicates that during the early cave period the climate

[1] See Mr. Turville-Petre's account in *Researches in Prehistoric Galilee,* London, 1927, p. 21. (Issued by the British School of Archaeology in Jerusalem.)
[2] *Prehistoric Galilee,* p. 27.

of Palestine was more favourable to man and beast than it now is. The conditions were certainly not arctic.

Can we apply to the caves of Palestine the system of chronology which has been worked out from the caves of Europe? It seems to me we have no option; there is no other chronology available. It may be that the Mousterian technique was invented by the Neanderthal men of Europe and spread thence eastwards, or the opposite may have been the case; it may have been initiated in the east and spread slowly to Europe. The palaeolithic stratum discovered by Mr. Turville-Petre in the Galilean cave may be younger or may be older than the corresponding cultural strata of European caves, but we may safely regard both as phases of the same long, elastic prehistoric period known as the Mousterian. All estimates of the duration of this period of human history are purely provisional; in this work we proceed on the belief that its duration was some 20,000 years, ending some 20,000 years ago. In the opinion of many experts, particularly in that of my friend Mr. J. Reid Moir, such estimates are altogether inadequate; they hold that the geological events of the Mousterian period were of such a kind that we must postulate a much longer duration and bring the period to an end, not 20,000 years ago, but 40,000 years. In any case, if we assign an antiquity of between 20,000 and 40,000 years to the palaeolithic stratum of the Robbers' cave, we are not overstepping the bounds of probability.

The Robbers' cave had been in existence long before palaeolithic man took up his home in it. In the deeper part of the cave a succession of strata, five in number and totalling 13 feet (3 metres) in depth, lay under the palaeolithic deposit. All were sterile; none of them contained any trace of man or of beast. It is also apparent that between the palaeolithic age and the coming of bronze-age man there is a great blank in the human record of the Robbers' cave.

Having dug his first long trench early in June 1925 and proved the extent and nature of the palaeolithic

stratum, Mr. Turville-Petre set his labourers to carry out a systematic investigation of the whole extent of the cave floor. He had found the implements of the cave men; they showed a high degree of skill; he had found proofs of their powers as hunters. What kind of men were they who frequented the shores of the Sea of Galilee so long ago? Always in Europe it has been found that the men of the Mousterian period were members of that strange extinct type of humanity—*Homo neanderthalensis*. Would the same prove true of the Mousterian culture in Palestine? Neanderthal man had been found in Europe as far eastwards as Krapina in Croatia[1]; he had been found as far southwards as Gibraltar; traces of him had been found in Malta. His culture has been found at many sites along the African shores of the Mediterranean but nowhere except in Europe had the actual fossil remains of the man himself been discovered. To settle the problem of the kind of man who fabricated the Mousterian implements in the Robbers' cave, Mr. Turville-Petre had not long to wait. As excavations were extended in June 1925 across the cave, near its mouth part of a human skull was found (see figs. 53, 54). It lay in the deepest part of the palaeolithic stratum, 6 ft. 10 in. (2·1 metres) below the original surface of the floor of the cave. The parts actually found (see figs. 55, 56) were the frontal bone, conveying all the characters of the forehead; the right malar or cheek bone, sufficient to indicate the contour of the upper face, and an important part of the base or floor of the skull—represented by the right half of the sphenoid bone. All were parts of the same skull; they fitted together perfectly. All had the same reddish-brown colour and the same degree of heavy mineralization, in the latter character resembling the animal bones found in the palaeolithic stratum. These fossil fragments lay under two blocks of limestone; there was nothing to suggest that the stones had been placed purposely over them.

[1] See p. 363. Remains of Neanderthal man were found in Southern Russia (Crimea) in 1925.

Thus only the front part of a human skull was found; diligent search failed to bring to light any other trace of the remaining parts of the skull, nor was any other fragment of human bone found. The cranial fragments bore no mark of violence—save that dealt to them by the Arab labourer's pick. They had become separated at their sutures or natural joinings from the rest of the skull. There is no question here of deliberate burial. Part of a human skull had been brought into the cave by design or accident and afterwards trampled underfoot with animal bones—the residue of feasts. It is not uncommon, when excavating former sites of human habitation, to come across isolated fragments of human bones. However this skull came to be entombed in the floor of the Robbers' cave, we cannot doubt that it represents the type of man who lived in Galilee in Mousterian times. Nor is there any doubt, as Mr. Turville-Petre was the first to recognize, that the individual represented by the skull was of the Neanderthal type. And yet we shall see he was a curious variant of that type. Evidently Neanderthal man had existed long enough in the world to have undergone differentiation into local or racial breeds. The differentiation of modern man into distinct racial type is evidence of a long evolutionary history.

CHAPTER XII

THE GALILEE SKULL AND TYPE

BEFORE proceeding to describe the characters of the cranial fragments of this ancient inhabitant of Galilee, which Mr. Turville-Petre found in the Robbers' cave, it will be convenient to discuss first certain matters relating to the sex and age of the individual. It is sometimes difficult to decide whether a modern skull is that of a man or of a woman; only when other parts of the skeleton are available, particularly the pelvis, can we make a certain diagnosis. The difficulty is greater in the case of Neanderthal skulls; sexual differentiation was apparently less pronounced in Neanderthal races than is the rule amongst modern races. Men have a more robust development of eyebrow ridges than women, and anyone looking at the forehead of the Galilee skull (fig. 55) will feel convinced that its owner must have been a man, so enormous is the development of these ridges. And yet, as I shall note presently, there are a number of points which have an opposite significance, and my final opinion is that the skull will prove to be that of a woman. Only further discoveries can settle the point. As regards age there is no room for doubt; it is that of a young adult. The sutures by which the frontal and sphenoid bones effected union with their neighbours were perfectly open at the time of death, indicating that the individual was under 30 years of age, probably under 25 years. There are, however, two unexpected features. The right and left nasal bones (fig. 55, N) are firmly ossified together, a union which takes place well after the age of 30 in modern man. On the other hand, the nasal bones become united during the babyhood or childhood of the gorilla and chimpanzee. In this respect the Galilee skull shows a simian feature. Also, a fragment of the upper jaw remains attached to the cheek bone (fig. 55, Max.), the suture between these elements being obliterated by bony union. In this feature also we see a simian trait. Indeed, as is well known, the

cheek region of the face of Neanderthal man is modelled on anthropoid lines.

There is evidence, at three places, of disease or of injury on the frontal bone. One of these is marked A in fig. 55. It is a shallow round depression in the bone, such a depression as the pulp of the thumb would make when applied to soft clay. The bone lesion had become

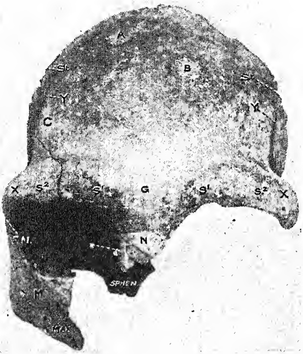


Fig. 55.—A frontal view of the Galilee cranial fragment. The specimen was poised on the Frankfort plane (from a photograph). A, B, C, the sites of cicatricial depressions; G, Glabella; S¹, supraciliary part of frontal torus; S² supra-orbital part; X, X, external angular processes; Y, Y, temporal ridges; F.M., fronto-malar suture; M, malar or zygomatic bone; Max, fragment of upper maxilla; N, united nasal bones; * ascending process of superior maxilla; Sphen., Sphenoid bone. St., Stephanion. Other explanations in text.

healed long before death, for the surface of the depression is covered by dense cicatricial bone. The nature of the original injury or disease which caused this depression has not yet been discovered. It is possible that it represents the results of a deliberate species of operation—an operation in which the bone was scraped in place of part of it being removed (trephined). Such an operation, besides the regular one of trephining, was practised by certain

races in neolithic times.[1] The other two sites of injury (fig. 55, B, C) show the results of past inflammation, but whether the inflammation was the result of blows or of some disease, such as yaws, cannot be determined. At least we can say that the earliest example of humanity so far discovered in Palestine bears on it marks of suffering.

Let us first enumerate the cranial characters which lead us to assign this ancient Galilean to the Neanderthal species. There are, in the first place, those of the forehead which are depicted in fig. 55. The forehead, just over the orbits, is crossed by a massive bar of bone, the *frontal torus*; in conformation and dimensions this exceeds anything known amongst modern races. When measured from end to end (fig. 55, X, X), it is 119 mm. in width. The same measurement in other Neanderthal skulls is: Gibraltar 118, La Chapelle 124, Neanderthal 122, Spy I 125, Spy II 124. In the width of its torus the Galilee skull falls in the lower range of the Neanderthal series. All are greatly exceeded by the primitive, non-Neanderthal Rhodesian skull in which the supra-orbital width reaches the maximum known in human skulls—namely 139 mm.—20 mm. more than in the Galilee skull. Amongst the most primitive of living races, the Australian aborigine, a common supra-orbital width is 113 mm.; among European male skulls, 106 mm. may be taken as a mean. It is rather in the conformation of the Galilean torus than in its dimensions that we recognize the Neanderthal type; the two elements which go to make up the torus—the supraciliary (S^1) and supra-orbital (S^2)—have the shape and degree of fusion which prevail in Neanderthal skulls. Particularly does the Galilee forehead copy the Neanderthal type in the region of the glabella (fig. 55, G) and where this region descends to merge into the root of the nose. The root of the nose is saddle-shaped.

On the other hand, the forehead of the Galilee skull differs from the Neanderthal type of Europe in the following characters: When the minimal frontal width is

[1] See *Antiquity of Man*, vol. i, p. 20.

taken between the temporal ridges (fig. 55, Y, Y) it is found to be 97 mm.; the maximal frontal width (taken between outer margins) is 113 mm. The Gibraltar skull is the smallest known of Neanderthal specimens, but its minimal frontal width is 102 mm.; its maximal, 120 mm. The same measurements in other Neanderthal skulls are still greater: in La Chapelle 109, 122, Neanderthal 107, 122, Spy I 104, 114; Spy II 100, 117. In its widths the Galilee frontal bone falls far below all other Neanderthal specimens, save one—that found at La Quina, a woman's skull. In this specimen the minimal frontal width is only 90 mm. In one Krapina skull (Krapina D) this measurement was 110 mm.; in another (Krapina C), 98·5 mm. Thus, with one exception, the Galilee skull was narrower in the frontal region than in other known Neanderthal specimens. We shall find, however, that it makes up for this lack of width in its height; the Neanderthal forehead is usually wide and low, but in the Galilean type it was narrow and high. In the smallness of its frontal dimensions the Galilee skull manifests female characters.

In one character of the forehead the Galilee skull is remarkably primitive. The supra-orbital width may be accepted as an index of "animal" development; the more robust the supra-orbital torus, the stronger is the build of jaws. On the other hand, the maximal frontal width depends on brain size; as the brain evolves in mass the maximal frontal width increases; while as jaws and teeth become reduced, the supra-orbital width tends to diminish. In the average Englishman, for instance, the maximal frontal width is 122 mm., the supra-orbital width 107, the former exceeding the latter by 15 mm. In the average male among Australian aborigines these two measurements are almost equal—112 mm. In the Galilee skull the opposite is the case; the supra-orbital width exceeds the maximal frontal by 6 mm. In only the Spy skulls is there so great a supra-orbital predominance; in Spy I, the supra-orbital torus is 11 mm. greater than the maximal width of the frontal bone. All these examples pale in degree of primitiveness when we take the Rho-

desian skull into account; its supra-orbital width is 21 mm. more than its maximal frontal width.

Thus in characters of forehead the Galilee skull represents a variety of the Neanderthal type. The malar or cheek bone (shown in figs. 55, 56, 57), on the other hand, is representative of the type; if only this bone had been found, it would have been sufficient to indicate the nature of the race which lived in the Robbers' cave in the

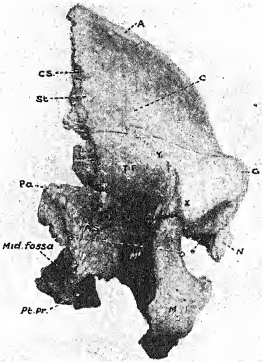


Fig. 56.—Profile of the Galilee cranial fragment (from a photograph). M, malar; M′, orbital plate of malar; A.S., great wing of sphenoid; Pt. pr., pterygoid process; Mid. fossa., floor of middle fossa of base of skull; T.F., temporal fossa; X, external angular process; Y, temporal ridge; G, glabella; N, nasal bones; A, C, sites of injuries; St., stephanion; C.S., coronal suture.

remote past. In fig. 57 the Galilee malar (A) is set side by side with a modern example (B); both bones are oriented on the same plane F, F, which, in front, crosses the margin entering into the formation of the lower border of the orbit (f) and while behind it corresponds to the upper border of the zygomatic arch (c); part of the hinder process of the Galilee malar has been broken away. The parts which rise above the line F, F, enter into the formation of the outer wall of the orbit; it is at

once seen how different in form and size the orbital processes of the two bones are. The parts below the line F, F, enter into the formation of the cheek, and it is very apparent that while the orbital process of the Galilee bone is the stronger and larger, it is the opposite with its cheek portion; in this the modern bone predominates. The malar bones represented in fig. 57 have been further divided by a vertical line—one drawn from the anterior end of the fronto-malar junction (b) to the anterior end of the attachment of the masseter muscle (e)—one of the main muscles of mastication. The reader will see that it is in the hinder, lower quadrant—the

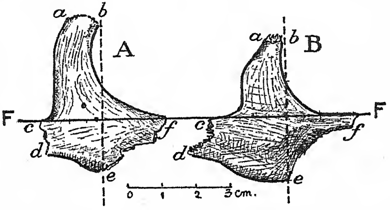


FIG. 57.—Drawing of the malar bone of the Galilee skull (A) set beside a corresponding drawing of a modern bone (B). a, b, fronto-malar suture; f, e. malo-maxillary border; c, d, zygomatic process; F, F, plane of orientation. Further explanations in the text.

masseteric portion—of the malar that the modern cheek bone so exceeds that of Neanderthal man. The high, prominent cheek bone characteristic of certain modern races is not a simian feature; it is the opposite. The low flat cheek bone of Neanderthal man is like that of the gorilla and chimpanzee; it merges into the upper jaw and seems to form but a process of that bone. The explanation of this expansion of the cheek portion of the modern malar must be correlated with a change in the mode of chewing and in the nature of the food consumed.

Besides the frontal and malar bones of the Galilee skull, the greater part of a third bone—the sphenoid—was found. Anatomists were thus provided, for the first time,

with an opportunity of making a minute study of the sphenoid bone of Neanderthal man. It, too, is marked by peculiar features. As may be seen in fig. 56 (A.S.), the sphenoid bone enters into the formation of the floor and side of the skull, just behind the frontal and malar bones. In Neanderthal skulls the great wing of the sphenoid (fig. 56, A.S.) and the orbital plate of the malar (M^1) are peculiar in extent and form. If we measure the distance from the margin of the orbit to the hinder border of the great wing (fig. 56, O, O) in the Galilee skull, the measurement being made parallel to the Frankfort plane, we find it to be 41 mm.; of this the malar part measures 20 mm., the sphenoid 21 mm. If we make the same measurement on a representative Australian (native) skull, the total distance is only 27 mm., the malar part being 13 mm., the sphenoid 14 mm. Malar and sphenoid bones make up a greater part of the floor of the temporal fossa in Neanderthal than in modern skulls. On the other hand, the hinder or parietal angle of the great wing of the sphenoid (fig. 56, Pa.) ascends higher on the side of the modern skull; in Neanderthal skulls the upper margin of the great wing is nearly horizontal. In all of these points the Galilee skull conforms to the Neanderthal type. Its most remarkable, and also its most simian feature is seen in the conformation of the hinder border of the great wing. In fig. 58, A, the Galilee sphenoid—only the greater part of the right half was found—is depicted from above; a similar view is given of a modern bone (fig. 58, B). In the modern bone there is an oval opening (d) for the transmission of a division of the fifth cranial nerve; in the Galilee fragment this foramen is seen to be represented not by an opening, but by a notch on the hinder border of the great wing, as is usual in the skulls of anthropoid apes. The hinder border of the great wing of the modern bone is seen to be more extensive and to project farther back at its spinous angle (g). There is no spine at the angle of the Galilee sphenoid, nor is there a separate opening for the middle meningeal artery. The sphenoidal air sinus was

large, and extended down into the root of the pterygoid process, as in the skulls of anthropoid apes. In all of these features we see characteristics of the Neanderthal type. We see, too, how deeply seated and how pervasive were the structural features of this extinct type of humanity. Most of the characters which mark the Neanderthal type off from the modern are anthropoidal in nature.

A survey of the cranial fragments confirms the opinion

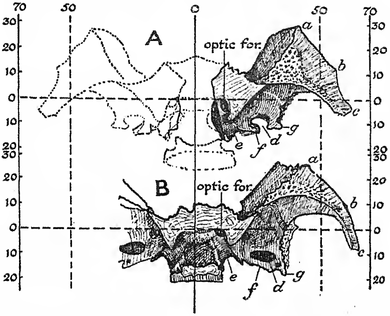


Fig. 58.—A drawing of the upper aspect of the right great wing of the sphenoid of the Galilee skull. (B) The corresponding aspect of a modern bone. Both bones were oriented and drawn on the same plane—one parallel to the small wings. a, b, articulation for frontal; b, c, articulation for parietal; d, foramen ovale; e, carotid groove; f, post-ovalar process; g, spinous angle.

that the ancient Galilean was of the Neanderthal type, and apparently a racial variant of that type. We now want to ascertain what may be inferred of the whole skull from a study of the parts at our disposal.[1] In fig. 59 a section of the frontal bone of the Galilee skull is depicted; it has been made along the middle line of the forehead from

[1] Readers who wish for more detailed information concerning the Galilee skull will find it in *Researches in Prehistoric Galilee*, by F. Turville-Petre. To this monograph, which was published by the British School of Archaeology in Jerusalem (1927), the author contributed a full description of the Galilee skull with an analysis of its characters.

the nasion (N), situated at the root of the nose, to the bregma (Br.), situated on the roof of the skull. A similar section has been made of the frontal bone of the skull of a male Australian aborigine—a skull which was of good length (192 mm.) and with a cranial or brain capacity of 1450 c.c., which is above the average for that race. The Australian bone is the thicker of the two; it has a mean thickness of 8 mm., whereas the Galilee specimen is, in

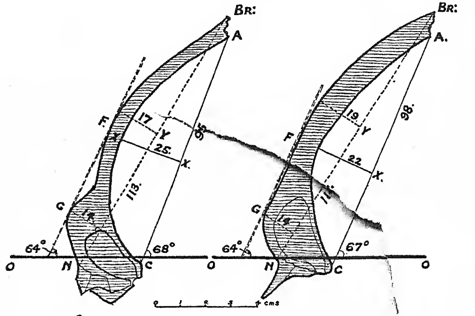


FIG. 59.—A section made along the middle line of the Galilee frontal bone from nasion (N) to bregma (Br.). A similar section of the frontal bone of an Australian aborigine. The figures represent millimetres. Both bones are orientated on the subcerebral plane, O, O. Further explanation in the text.

most parts, only 5 mm. in thickness; at the site of the frontal bosses and near the bregma, however, it increases to 7 mm. Most Neanderthal skulls have thick walls; only two specimens, the La Quina and Krapina (C), are as thin as the Galilee frontal; both of these are believed to be the skulls of women. Even in the region of the glabella (G) the Australian is the thicker; the bone here measures 21 mm., whereas in the Galilee specimen the measurement is only 18 mm. It is the contour of the glabellar region, not its thickness, that distinguishes the

Neanderthal type. The frontal sections represented in fig. 59 do not differ much in curvature nor in absolute dimensions. The chord of the Galilee bone, taken between the nasion (N) and bregma (Br.), is 113 mm. in length; the chord length of the Australian specimen is almost the same, 114 mm. If we measure along the outer curve of the bone, from nasion to bregma, the Galilean measurement is 125 mm., the Australian, because of its thickness, rather more, namely, 130 mm. The frontal arc in known skulls of the Neanderthal type varies in length from 105 to 133 mm.; in this respect the Galilee frontal exceeds the mean. The Galilean forehead was not receding; that is indicated by the curvature of the bone. At its most prominent point the arc of the frontal bone rises 17 mm. above the frontal chord (see fig. 59, Y). The height of the arch gives a measure of the external curvature of the frontal. More valuable to us is the internal curvature, because within the concavity of the frontal bones lies the frontal lobes of the brain; it is the brain-containing capacity of the bone which is of chief interest to us. The internal chord of the frontal bone is drawn from the foramen caecum (fig. 59, C) to the internal bregma (A). In the Galilean frontal the internal chord measures 95 mm.; in the Australian specimen 98 mm. The greatest depth of the curve is at X, X, fig. 59; it measures 25 mm. in the Galilee skull; 22 mm. in the Australian. The Galilee skull had the greater frontal capacity. The frontal bone may undergo extensive remodelling during the years of adolescence; the forehead, which is vertical or even protuberant in childhood, may become receding by the time adult years are reached, but in this change the interior of the frontal bone changes much less than its exterior. One has but to look at the curvature of the Galilean frontal as seen in section (fig. 59) to realize that in childhood its owner had a high, upright, almost protuberant forehead.

We may approach the problem of the poise of the Galilean frontal in another way, one which leads on to an attempt to reconstruct the whole skull. In fig. 60 the

frontal bone is oriented on the line O, O, which represents the subcerebral[1] plane. As so poised the highest point of the frontal—the bregma—lies 92 mm. above the base line, O, O. The reader may well ask: How was this height arrived at? In this way: The longitudinal arc of the Galilean frontal, being almost the same length as that of the Gibraltar frontal, I supposed at the outset

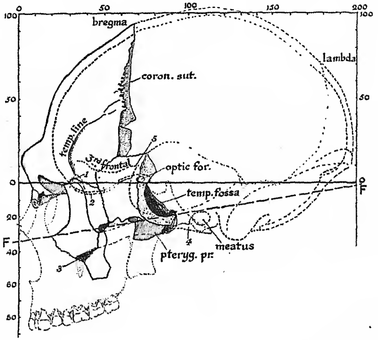


Fig. 60.—The Galilee cranial fragments oriented on the subcerebral plane (O, O). The position of the Frankfort plane (F, F) is also indicated. The stippled lines represent a hypothetical reconstruction of the missing parts. The framework of lines is 100 mm. high and 200 mm. long. (1) crista galli, (2) cribriform plate, (3) masseteric attachment, (4) basilar process, (5) junction of roof of orbit and middle fossa of base.

of my inquiries that the height of the bregma might also be the same. So in my first orientation I placed the bregma at the 82-mm. level. When so placed, all the parts of the sphenoid bone, the optic foramen, the sphenoidal fissure, the foramen rotundum, were thrown into impossible positions in their relationship to the orbit; it was not until the bregma had been raised until the 92-mm. level was reached that these parts assumed a

[1] For a description of this plane and the framework of lines erected on it, see vol. ii, p. 580, *Antiquity of Man.*

relationship which holds for all human and anthropoid skulls. The bregma of the Galilean skull may be a little higher than is shown in fig. 60, but not lower. Of known Neanderthal skulls, in only one—the massive Spy II, is the bregma higher; in it the bregmatic height is 98 mm. So low roofed are the Neanderthal skulls that in the La Chapelle specimen, which has a capacity of 1600 c.c., the bregmatic height is only 88 mm., in Spy I 81 mm., in the original Neanderthal skull 90 mm. The Galilee skull was high-roofed as are most modern skulls. We may also make an approximate estimate of the height of the bregma above the Frankfort plane which is indicated in Fig. 60 F, F. This plane cuts the lower margin of the orbit and the upper margin of the external ear passage. The ear passage is missing in the Galilee skull, but the floor of the middle fossa of the base (fig. 60, temp. fossa) is present, and as its deepest part lies on or near the Frankfort plane we may substitute this guide for that of the meatus. In European (male) skulls the mean bregmatic height varies between 114 and 118 mm. The estimate for the Galilee skull is 116 mm.; in the Gibraltar skull it is only 98 mm., in La Chapelle 109, Spy I 107, Spy II 120, Krapina "D" 110 mm. Herein we have evidence which confirms the high pitch of the roof of the Galilee skull.[1] Always in human skulls, both of the modern and Neanderthal types, the cranial vault, when a skull is placed in the subcerebral plane, continues to rise for a distance of 30 or even 50 mm. behind the bregma. In the reconstruction shown in Fig. 60, the roof is made to reach and slightly surpass the upper horizontal which is placed 100 mm. above the subcerebral plane. This is the level reached by modern skulls of good capacity (compare fig. 70, p. 201, vol. i of *Antiquity of Man*).

[1] Those who prefer to use Schwalbe's base line—one joining glabella and external occipital protuberance—may wish for an estimate of the height of the bregma on this plane. My estimate for this measurement in the Galilee skull is 81 mm. This is to be compared with measurements made on the following skulls: Gibraltar 73, La Chapelle 77, Neanderthal 86, Spy I 72, Spy II 84, Krapina "D" 86. As to the unsatisfactory nature of Schwalbe's base line, see *Antiquity of Man*, vol. ii, p. 580.

The Galilee type differed from the Neanderthal type of Europe in having a high-pitched cranial roof; it also differed in having the skull narrow instead of wide. The tendency of the Neanderthal skull is to compensate in width for what it lacks in height. The La Chapelle skull, for example, is very wide; at its widest point it measures 156 mm.; even the Gibraltar skull has a maximum width of 142 mm. We have only the width of the frontal bone, and of the sphenoid, to guide us to the probable measurement attained by the Galilee skull at its widest point. From such indications it is justifiable to infer that the width was between 135 mm. and 140 mm.[1] Only the La Quina skull, which is that of a woman, is so narrow; its maximum width was 140 mm. As to the probable length of the Galilee skull, we may infer that the parietal and occipital bones maintained the same proportions to the frontal as in European examples of the Neanderthal type. It is on this assumption that missing parts of the Galilee skull have been reconstructed in Fig. 60. The total length was between 190 and 200 mm.; the actual length shown in Fig. 60 is 195 mm.

Thus the results of my investigations were to lead me to the following conclusions: (1) That in ancient times Palestine was inhabited by a race which represented a variant of the extinct Neanderthal type of humanity. This variant was characterized—among other features—by height and narrowness of head. (2) From a study of the fragments found I infer that the original skull had a length of about 195 mm., a maximum width of about 138 mm., the width being about 70 per cent. of the length: it was a dolichocephalic skull. The highest point of the roof rose about 118 mm. above the Frankfort plane. From these dimensions one infers that the volume of brain—the cranial capacity—must have been in the neighbourhood of 1400 c.c. The mean capacity for modern Englishmen is about 1480 c.c. (3) Although the sex markings are equivocal, yet in the author's opinion the majority of them indicate that the skull was that of a

[1] The basis for this estimate will be found in *Prehistoric Galilee*, p 66.

woman rather than of a man. Only further discoveries can resolve the problem of sex. The person represented by the skull was a young adult.

Certain features of the brain of this individual can still be studied, for the chief convolutions of the frontal lobes have left sharply marked impressions on the inner aspect of the frontal bone. A cast taken from the interior of the bone reproduces these convolutions and the sulci or depressions which separated them. In a future chapter [1] the interpretation of endocranial casts taken from fossil human skulls will be discussed and the convolutionary pattern of the Galilean woman described. Meantime it is enough to say that the convolutionary markings are altogether human and quite comparable to those seen in casts taken from the interior of skulls of lower living races. Indeed, in their conformation the frontal lobes of this ancient Galilean are reminiscent of the Australian aboriginal type.

In this and in the previous chapter I have given an account of the important discoveries made by Mr. Turville-Petre in his first season in Palestine. Fortune smiled on him when he set out to explore the hills and caves of Galilee in the spring of 1925; she gave him, at his first attempt, the reward which comes to most explorers, if it comes at all, after years of search. Fortune favoured him, but he knew how to use her favours when they came. By a fortunate turn of the spade he carried the history of Palestine far beyond the oldest records of Egypt or of Babylonia—to a time when that part of the East which much later became known as the Holy Land was the home of a strange and primitive type of humanity. Like every important discovery, this one in Galilee, while it answered certain questions, also raised others. It has told us that the Neanderthal type of Europe extended into the East, but leaves us wondering how much more towards the East we shall have to go before we find its farthest limit. As we go eastwards, shall we find Neanderthal man replaced by the fossil ancestor of modern

[1] Chapter XXXII, p. 480.

races? Mr. Turville-Petre's discovery has made certain that the Galilean variant of Neanderthal man fashioned his tools in the same manner as his cousins in Europe, but gives us no information as to whether the Mousterian culture of France was derived from Palestine, or that of Palestine from France, or—as well may be—whether both were derived from a common source. This discovery in Palestine also bears upon the general problem of human evolution. The ancient Galilean was not the pure Neanderthal type, but a variant of the type; his culture was not the pure Mousterian, but a variant of that culture. The men and their culture were undergoing, or had undergone, a local differentiation; in other words, both were being evolved. We still have to find out when men of the modern type began to arrive in Palestine and where they came from. The discoveries which are dealt with in the following chapters go some distance towards an answer.

CHAPTER XIII

THE LATER CAVE MEN OF PALESTINE

HISTORY as written in the floors of caves is a thing of shreds and patches. A cave might be occupied by palaeolithic hunters for many generations, so that a thick stratum became trampled underfoot. Then, for some reason, the cave was forsaken, and before it again became a home for man the culture of the hunters had passed through several phases. These missing phases have to be searched for in other caves. Before the end of the nineteenth century the archaeologists of France recognized that, to obtain a complete sequence of the palaeolithic cultures of their country, it was necessary to add the records obtained in one cave to those obtained in several others. In this way they were able to establish the order in which the various stone cultures appeared in France and to provide a provisional chronology for the events of the palaeolithic world.

We must expect that the caves of Palestine will provide us, like those of Europe, with broken and interrupted records of prehistory. We have only to examine the strata which Mr. Turville-Petre exposed in the floor of the Robbers' cave to be convinced that this is so. Under the palaeolithic stratum of that cave (fig. 54, p. 179) he found many feet of deposits which contain no human records, yet we know that when these were being laid down man's palaeolithic culture was passing through two very long stages in Europe—the Chellean and Acheulean. The records of these phases of human existence are to be searched for, not in caves, but in the terraces and deposits laid down by rivers and streams in their valleys. In the river deposits of Palestine implements worked in the Chellean and in the Acheulean manner occur; Palestine was inhabited long before Mousterian hunters took up their habitation in the Robbers' cave. In the strata of that cave (fig. 54) only a layer of fallen blocks of limestone separates the period of

the Mousterian culture from that of the bronze age. Yet we know that in Europe human culture passed through a long series of phases between the Mousterian period and that of the bronze age. In our provisional chronology the Mousterian culture and Neanderthal man ceased to exist in Western Europe some 20,000 years before our era began; the use of bronze reached Western Europe about the same time as Abraham migrated from Ur of the Chaldees to Palestine—2000 B.C. It is probable that bronze was used in Palestine at least 500 years before Abraham's time. If, then, we apply to the strata of the Robber's cave the chronology of palaeolithic Europe, we see that there is a great blank in its records. This blank lies between the stratum which registers the events of the Mousterian period and that which preserves those of the bronze age. In this long interval—one which covers 16,000 or 17,000 years, palaeolithic culture in Europe passed through its final or late phases—Aurignacian, Solutrean, Magdalenian, which were followed by several mesolithic and neolithic phases (see fig. 162, p. 464). Were there corresponding late palaeolithic cultures in Palestine?

Before excavating the Robbers' cave in June 1925 Mr. Turville-Petre had already found a partial answer to this question. He discovered it in the three Emireh caves or rock-shelters which, as it will be remembered (fig. 52, p. 177), are situated on the southern aspect of a limestone bluff which rises from the plain of Gennesaret just before one enters the Wady-el-Amud to reach the Robbers' cave. Trenches dug in these rock-shelters revealed great disturbance in the strata of their floors. It was plain that, like the Robbers' cave, they had been occupied in the bronze and later ages, for fragments of pottery characteristic of these ages were found mingled in the disturbed deposits of the floor. Outside the shelters in the platform or terrace which extends in front of them, Mr. Turville-Petre [1] discovered an intact stratum laid down when cave men occupied the Emireh shelters. This palaeolithic

[1] See *Prehistoric Galilee*, p. 3.

stratum was fully 2 feet (0·70 m.) in thickness; it lay under an upper stratum or crust of earth measuring in most parts about 1 foot in depth. In the clay of the palaeolithic stratum fragments of animal bones occurred in abundance; they were fossilized. Miss Bate identified the bones and found almost the same fauna as that of the Robbers' cave. But the implements contained in this stratum differed from those of the Robbers' cave; the prevailing types resembled those which occur in the Aurignacian and later cave cultures of Europe, whereas those of the Robbers' cave represented the older or Mousterian culture of Europe. It is clear, then, that the palaeolithic stratum of the Emireh caves is later than that of the Robbers' cave; the Emireh caves supply one of the many pages which are missing in the records of the Robbers' cave.

The Mousterian culture of the Robbers' cave differed, as we have seen, from the corresponding culture of Europe in several respects. It contained some flint implements which are reminiscent of a culture older than the Mousterian—the Acheulean, and also others of types which are met with in the later cave cultures of Europe. The same wide range was observed in the types of implements from the Emireh caves. There occurred "points" and "side-scrapers" which bore marks of the Mousterian technique and also many pygmy flints—microliths—which in Europe indicate a transition in culture from the palaeolithic to the neolithic forms. Neither the older nor the later cave men of Palestine copied slavishly the cave men of Europe. Indeed, archaeologists in their search for palaeolithic cultures which most resemble those of Palestine find them not in Europe proper but in that part of Europe which lies south of the Mediterranean—Algiers and Tunis. The prevailing late cave culture of North Africa has been given the name "Capsian"; it was contemporary with and first cousin to the later Aurignacian of Europe. The palaeolithic culture of the Emireh caves was "Capsian" in its affinities. Was it derived, then, from North Africa? There is always a

tendency to suppose that the land in which a culture or fauna is first discovered, or where a culture or a fauna is best preserved, is the cradle of evolution or centre of distribution of that culture or fauna. It is a tendency which may mislead us instead of guiding us to the truth. Wherever the Capsian culture may have been elaborated first, there is no doubt it prevailed along the southern and eastern shores of the Mediterranean, from Morocco to Palestine. In late palaeolithic times Palestine lay within the African, not the European circuit of culture.

We now come to seek answers to some questions of great interest: Were the men of the Emireh caves, like those of the Robbers' cave, Neanderthal in type? Or were they, as were the later palaeolithic men of Europe, of the modern type? It seems possible that the late palaeolithic culture of the Emireh caves might have been evolved, without break, from the older Mousterian culture of the Robbers' cave. Might it not be that here, too, Neanderthal man had undergone evolutionary changes which transformed him into modern man? Or is it to be in Palestine, as in Europe, that the Neanderthal type was suddenly replaced by invaders of another type just as the aboriginal type of Australia is now being replaced by a European type? And if we find sudden replacement, is the race which invaded Palestine in later palaeolithic times to be the same as that which invaded Europe and replaced Neanderthal man? The palaeolithic stratum of the Emireh cave did not provide Mr. Turville-Petre with answers to these questions. He found only one piece of human bone—a fragment of the parietal bone. In its characters this fragment suggested the modern type of man, but the evidence was too slender to carry conviction. To obtain answers to our questions we have to move the scene of our inquiries from Galilee to the Shukbah cave situated in the Wady-en-Natuf on the ~~eastern~~ slopes western of the Judean Hills near the railway which carries passengers from Joppa to Jerusalem (fig. 61).

In the spring of 1926, when Mr. Turville-Petre returned to complete the excavation of the Robbers'

cave, another student of the Oxford School of Anthropology, Miss Dorothy Garrod, began the excavation of a rock-shelter, of Mousterian date, at Gibraltar. The important discoveries she made there in 1926 and in the following season of 1927 will be described in a subsequent chapter.[1] Miss Garrod comes into my narrative here because in the spring of 1928 she joined the British

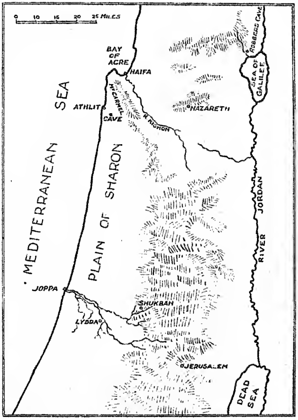


FIG. 61.—Sketch map of Palestine showing the position of the Shukbah and Athlit caves.

School of Archaeology in Jerusalem, and in her first season's work in Palestine made a notable discovery. Leaving Jerusalem, which is 30 miles distant from the Mediterranean and 2593 feet above its level, Miss Garrod descended the western slopes of the Judean Hills until she reached Lydda (fig. 61) and from there made her way to the Wady-en-Natuf in which the cave of Shukbah it situated. The scene of her labours lies 80

[1] Chapter XXII, p. 341.

miles southward from the cave examined by Mr. Turville-Petre, but the hills of Judea are of the same limestone formation as those of Galilee, and provided ancient man with equal facilities for natural shelter. The cave had the ample dimensions of the Robbers' cave; it is situated on the western slope of the Judean Hills, half-way between Jerusalem and Joppa, 1000 feet above sea-level and 12 miles distant from the railway station at Lydda. Miss Garrod set her gang of Arab labourers to work, and before the heat of midsummer had brought her first season's exploration to a close, had penetrated all the deposits which had accumulated in the cave and reached rock-bottom. The floor of the cave was irregular; the deposits which had accumulated on it varied in depth from 7 to over 20 feet. She intended to return and complete the exploration of the cave in the following season (1929), but, as we shall see, was called upon to spend that season in supervising the excavation of a promising site at Mount Carmel. Thus at the time at which I write (1930) a full report of what Miss Garrod did and found in the cave of Shukbah has not appeared, but so important do her discoveries seem to me that I have obtained her consent to mention their general bearing on the problem of human beginnings.

In the deepest stratum of the cave there was an abundance of the same flint implements which Mr. Turville-Petre has found in the Robbers' cave—a rich display of what may be called the Palestinian Mousterian, the culture of Neanderthal man. But the deepest stratum at Shukbah was not in the undisturbed intact state of that found by Mr. Turville-Petre in the Robbers' cave; a later palaeolithic people who, fashioning their stone implements in the Capsian manner, the same manner as that of the men who occupied the Emireh rock-shelters in Galilee (p. 200), had made the Shukbah cave their home for many generations. Massive deposits, through which were scattered blocks of fallen limestone, had accumulated in the cave during the period of the Capsian occupation. The occupants of this later period had dug into

and disturbed the floor on which the Mousterian workers had lived.

In the deepest but disturbed stratum, which carried the Mousterian culture, Miss Garrod obtained the following human fragments: (1) a lower molar tooth of the right side; (2) a fragment of a temporal bone; (3) upper part (tabular) of a frontal bone; (4) a second fragment of frontal bone; (5) a left malar or cheek bone; (6) the right half of a palate; (7) lower end of left thigh bone; (8) lower end of a second left thigh bone; (9) a left astragalus. Now the three items mentioned first—the molar tooth, the fragment of temporal and of frontal, differed from all the others in being much more mineralized or fossilized; they were extracted from hard masses of breccia; the others were obtained in a looser earth. They differed, however, in a much more important way—the molar tooth was beyond doubt that of Neanderthal man; the temporal fragment almost certainly so, and the frontal fragment possibly so. The other bones—frontal, malar, palate, thigh bones and astragalus—were those of a race of modern man; in anatomical characters and in state of preservation they agreed with the numerous human fragments and burials which occurred at all levels of the pure Capsian deposits. Here, then, in this cave in a limestone ravine of the hills of Judea, Miss Garrod obtained evidence that the first people to occupy Shukbah were Mousterian in point of culture and Neanderthal in point of race. At a later date the cave was occupied by a people who were Capsian in culture and belonged to a totally different branch of mankind—a branch which represented modern or neanthropic man.

From a superficial consideration of the evidence we may be led to infer that here in Palestine, as in Europe, Neanderthal man was suddenly replaced by modern man. This would be so if the folk who practised the Capsian culture took possession of the cave immediately after those who used the Mousterian technique had died out. We cannot suppose this to have been the case; the state of fossilization of the Neanderthal bones is so much

greater than that of the later inhabitants, the Natufians,[1] that we must suppose a considerable interval of time elapsed between the first and second periods of occupation of the cave.

A full description of the human remains found at Shukbah cannot be given until Miss Garrod has completed her excavation and prepared her final report for publication. The characters of the Neanderthal molar tooth, however, are so important that the more striking of them will be mentioned here. The dimensions of the tooth are remarkable; the length (medio-distal diameter)

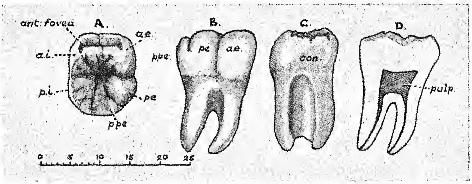


FIG. 62.—Molar tooth from the deepest (Mousterian) stratum of Shukbah. It is the second lower tooth of the right side. (A) Upper or chewing surface; a.i., anterior internal cusp (metaconid); p.i., posterior internal cusp (entoconid); a.e., anterior external cusp (protoconid); p.e., posterior external cusp (hypoconid); p.p.e., post-postero-external cusp (hypoconulid). (B) External or buccal aspect. (C) Anterior aspect; con., area of contact with first molar. (D) X-ray of tooth (from buccal aspect) to show size of pulp cavity.

of the crown is 13·5 mm.; its width—rather greater in its posterior than in its anterior moiety, is 12 mm.; such dimensions exceed those of the corresponding tooth of Heidelburg and of Piltdown man; the only known tooth which equals it in dimensions and resembles it in cusp characters is one from a Krapina youth (C). The Shukbah molar, like that from Krapina, is almost unworn; it had erupted a short time before the death of its owner; there is an impress on its anterior aspect made by contact

[1] Miss Garrod proposes to name the particular form of the Capsian culture practised by the Shukbah people, Natufian I, from the Wady-en-Natuf in which the cave is situated. We may also name the later inhabitants of the cave Natufians.

with its neighbour in front, but none on its hinder aspect. The Shukbah tooth is that of a lad about 12 years of age; with such a tooth the length of his molar series, had he lived, could not have fallen far short of 40 mm.; the total length of his dental palate, as estimated in *Antiquity of Man*,[1] would have been about equal to that of the La Chapelle man, 65 mm.

There is nothing degenerate in the cusp development of the crown; all five cusps are fully and regularly formed (fig. 62); the enamel on them has a sharply cut crystalline form; the two anterior cusps are united by a prismatic bar; in front of this bar lies a well-marked anterior fovea (fig. 62, A). Indeed, the tooth gives a beautiful exemplification of Dr. Gregory's Dryopithecoid type [2]; except that on the shallow cup formed by the three hinder cusps (the talonid) there is only the suspicion of a posterior fovea. The total height of the tooth, from tip of cusp to end of root, is 20·2 mm., the crown making up 6·2 mm. of the total height. The pulp cavity is large (fig. 62, D), extending down into the body of the tooth, thus curtailing the length of the roots (fig. 62, B). Only a moderate degree of taurodontism is present—much less than in the Krapina molar tooth. Such a combination of characters never occurs in the molars of men of the neanthropic type; only in those of the Neanderthal stock.

The fragment of temporal bone, deeply mineralized, found in the deepest stratum is shown in fig. 63. It carries part of the joint for the lower jaw, the articular eminence (b), the root of the zygoma (c), part of the squama (e), part of the roof of the ear (d), and particularly the post glenoid process (a). The fragment is from an immature skull; it may well be part of the same individual as the molar tooth. Its dimensions show its immaturity; its total length, from tip of post-glenoid spine to anterior margin of articular eminence, is only 14·5 mm.; the width of the articular surface is only 18 mm.; these dimensions fall far short of adult measurements in every race of mankind.

[1] See vol. ii, chapter xxxiv, p. 661.
[2] W. K. Gregory, *The Evolution of Teeth.*

The post-glenoid process (fig. 60, A) for such a stage of immaturity is of remarkable size and strength. At its base it is 13·5 mm. wide; its sloping anterior surface measures 7 mm.; the apex of the process descends 4·2 mm. below the level of the highest point in the glenoid depression. Such a combination of characters I can find in only one known specimen—the temporal bone of a Neanderthal youth (C) unearthed at Krapina. The fossilized tabular part of the frontal bone seems also to be part of a young skull; its thickness varies from 4·5 to 6 mm. It is likely that all three fragments—found in the same stratum and not far apart—belonged originally to

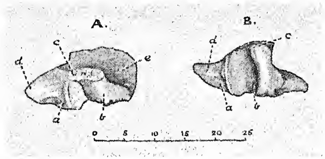


FIG. 63.—(A) View of the temporal fragment from the Shukbah cave seen from the side and from below. (B) The lower aspect of the same fragment: a, post-glenoid process; b, articular eminence; c, root of zygoma; d, supra-meatal part; e, part of temporal squama.

the same young individual. The tooth was not a loose member which had dropped from its socket; remains of decaying alveolar bone covered its roots when first found. The evidence is scant, but such as it is makes it probable that the Shukbah youth was of the same Neanderthal breed as that represented by the Galilee skull.

Miss Garrod found that Shukbah cave in Capsian times had been a cemetery—a charnel house—as well as a home for its occupants. Throughout the Capsian deposits, which had a total thickness of 20 feet, she met with the sites of hearths, splintered and broken bones of gazelle, deer, ox, etc., remnants of meals, flint implements worked in the earlier Capsian manner, and at every level burials and scattered human bones. When I had arranged and compared all the human bones which Miss Garrod

exhumed from the Capsian deposits, I found that no less than 45 individuals were represented in the assemblage. All periods of life were present, from birth to old age. In my census were enumerated 16 men, 9 women, 17 children; 3 other adults have to be added, but in their case the evidence was too fragmentary to permit a diagnosis of sex. Only in a few instances had the bodies been left undisturbed after burial; even where there had been no disturbance the weight of the superincumbent load of cave earth and rock had pressed down, flattened and fractured every bone. Of the 45, only 8 had a representation of all parts of the skeleton; even in these the spongy bone had decayed; not a single bone was left intact. In the majority of cases all that was left to tell of the existence of an individual was one or more fragmentary bones of the limbs or of the skull.

A long experience of the injuries which human bones may suffer after burial, from earth pressure and reburial—which is necessary when many interments are made in a limited area—have made me sceptical of reports which attribute cannibalistic or other unnatural practices to prehistoric peoples. In most cases such reports are based on the fractured state of bones or disturbance in the arrangement. Evidence to be conclusive must prove (1) a bone was fractured when fresh—which can usually be inferred from the sharpness of the splinters of dense bone and the texture of the broken surface of the cancellous bone; (2) there must be apparent on the bone cuts or depressions such as are caused by blows of cutting or bruising implements. Now, amongst the human bones scattered through the Capsian strata of Shukbah there are certain pieces which leave no doubt that they were intentionally cut and fractured while still fresh. There is, for example, a square piece cut from the forehead, nearly as large as the palm of the hand; it includes the root of the nose, the inner parts of the roofs of the orbits and ascends as far as the upper limit of the frontal eminences. At each side of the fragment is the mark of a sharp cut; there are marks of the blows which separated it above and below.

The removal of such a window made the brain accessible. Was the brain an item on the menu of their cannibalistic feasts—or was it part of a death ritual? In one of the skeletons found towards the bottom stratum of the cave a blow with a sharp instrument had separated the trochanter of the thigh bone. In this case we seem to have evidence of a wound rather than of any act of cannibalism. Nevertheless, several of the long bones and many fragments of skull have definitely been broken by a sharp instrument when in a fresh condition, and we must conclude that the Shukbah people—the Natufians—did not restrict their dietary to the four-footed game of the Judean Hills.

What kind of people were the Natufians? They were people of short stature; a comparison of the various parts of limb bones with the corresponding parts of ancient Egyptians makes me confident that the stature of the men varied between 5 ft. and 5 ft. 3 in. (1525–1600 mm.). While the shafts of their long bones were stout, yet those of the hand and foot were small and rather delicate. The bones of the foot had extensive articular surfaces; their feet had supple joints. The lower or distal ends of their humeri were usually perforated. They were a dolichocephalic folk; their heads were narrow and rather long—resembling in their dimensions those of the predynastic Egyptians. For example, in the best preserved skull—that of a man—the length was 189 mm., but the width only 128 mm. This skull was high vaulted, its height above the ear passages being 118 mm. Their faces were short, their total length being 110–115 mm., and not wide (bizygomatic width, 126 mm.). They were totally different from the Cromagnon folk of Europe, in stature and in size and strength of jaw. Their jaws were of moderate development, and their chins of medium predominance. The nose, in proportion to the length of the face, was long and also wide (see figs. 67, 68, p. 221). The nasal bridge was not narrow and raised; the nasal bones, of ample length, formed a wide, flat arch. Their type may be described as Mediter-

ranean, but with a distinct bias towards the African variety of that stock represented by the predynastic people of Egypt. They were hunters, knowing nothing of pottery or of agriculture. In Capsian times Palestine was still a barbarous country; not the faintest glimmer of dawning civilization can be recognized, and yet, in some not distant part of the earth, some race of people must have been taking the first steps which brought about the great Exodus—the exodus from savagedom.

The later cave dwellers of Shukbah practised a rite which is still observed by many negro tribes of Africa. They removed one or both upper central incisors in youth, which resulted in atrophy of the corresponding alveolar part of the upper jaw and in an upgrowth of the unopposed lower incisors. In fig. 64, a drawing is reproduced of the right half of the palate of one of the Shukbah people; it came from the deepest stratum of the cave, and has male characters. The missing left half has been replaced in my drawing by duplicating the right half. The total area of the palate, thus reconstructed, is below the mean for modern Europeans, being approximately 24 cm.[2] Its length, measured as shown in fig. 64, is 46·5 mm.; if the upper incisors had been present the length would have reached the European average—50 mm. It was not wide—64 mm. at the utmost—nor deep. Its depth between the 2nd pair of molars was only 17 mm. The three molar teeth are preserved in their sockets; their total length is 28·4 mm.; their dimensions decrease slightly from 1st to 3rd. All these points I mention as evidence that the jaws of the cave people had undergone a certain degree of retrogression, but my main object is to draw attention to the practice of removing the upper incisors. If only one example had been found, the early loss of an upper incisor might be attributed to accident. Altogether five palates were sufficiently complete to give evidence bearing on this practice. In only one palate are we certain there was no extraction. In one case extraction was confined to the upper incisor of the right side. This may also have been the case in the

palate represented in fig. 64, for we have only the right half to guide us. In another instance both central incisors had been extracted. In the fifth palate only the left half was preserved; in the right half, the central incisors may or may not have been extracted. In three of five men one or both upper central incisors had been removed in early

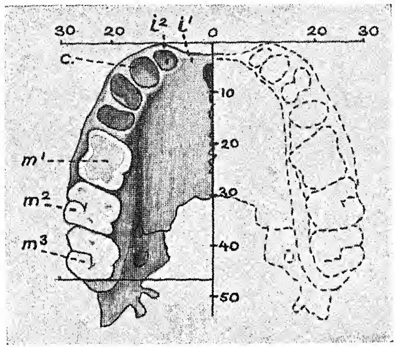


FIG. 64.—Drawing of the right half of a palate from the deepest stratum of Shukbah to show atrophy of the part of the palate which carries the upper central incisor—consequent on early removal of the tooth. The missing left half of the palate is indicated by stippled lines—copied from the right half. Measurements are given in millimetres, the length of the palate being indicated on the median line by one which has been drawn behind the last molar. The width is measured between the outer borders of the 2nd pair of molars : i^1, position of socket for upper central incisor; i^2, socket for 2nd upper incisor; c, socket for canine; m^1, m^2, m^3, 1st, 2nd and 3rd molar teeth.

youth. Evidence of the practice is found in the uppermost as well as in the deepest stratum of the cave.

It so happened, a little before the British School in Jerusalem submitted to me human remains from Shukbah, that Mr. Alonzo W. Pond, who had been excavating a Capsian site in Algeria, came to see me. He told me he had found evidence of extraction of central incisor teeth. The site which he had explored on behalf of the Logan

Museum, Beloit College, Wisconsin, was not a cave, but a vast midden-heap situated on a plain between hills, some 40 miles to the south-west of Constantine. The midden represented an ancient Capsian settlement; it is made up chiefly of kitchen debris; snails provided one of the main sources of food, and discarded shells form a large part of the heap, which has a depth of over 6 feet. At all levels occur hearths, implements of flint and of bone, and human burials. The implements—the culture—was almost the same as at Shukbah, although the two sites lie nearly 2000 miles apart. Gafsa, in southern Tunis, which provided the original type of the Capsian culture, is only 200 miles from the midden-heap at Mechta-el-Abri excavated by Mr. A. W. Pond.[1]

The people of this Algerian midden-heap had the Shukbah habit of burying their dead in the debris which accumulated on the site of their habitation. Altogether between 1907, when French archaeologists began the investigation of this mound or midden-heap, until 1927, when Mr. Pond obtained permission to continue their work, about a score of burials had been found. As at Shukbah, the remains of children were as plentiful as those of adults. As at Shukbah, the bones were broken and distorted by earth pressure. Wilful hacking was not observed, but there was the same practice of removal of the incisor teeth in youth. In the four skeletons which Dr. Fay-Cooper Cole examined from the midden site—one female and three male—the upper central incisors had been removed in all cases, and in some the corresponding lower incisors as well.

When we take into consideration the distance of Algeria from Palestine, and the antiquity of the two peoples we are considering—for the Capsian culture of North Africa is regarded as contemporary with the later Aurignacian of Europe—it is remarkable to find such a degree of

[1] An account of his excavations will be found in the *Logan Museum Bulletin*, vol. i, No. 2, 1928: "A Contribution to the Study of Prehistoric Man in Algeria, North Africa." A valuable account of the pleistocene fauna is given by Professor A. S. Romer, and of the Human Remains by Dr. Fay-Cooper Cole.

correspondence between the cultures of Algeria and Palestine—particularly that they should have the practice of incisor extraction in common. Were the two peoples the same? They were certainly not of the same physical type, and yet may well have been branches of the same human stock—the Mediterranean. We have to remember the tendency which every isolated community has to differentiate into a local type, and also the fact that neither Dr. Cole nor the writer had at their disposal skulls and limb bones which were intact and undisturbed. Nevertheless, the Shukbah people differed from the Algerian type in the narrowness of their skulls and in the profile of their heads. The midden people had bigger and wider heads; their brows tended to recede, and their occiputs to be high and rather steep. A similar type can be recognized in some of the living Kabyle of North Africa. On the other hand, the Shukbah people seem to me to find their nearest analogues in the predynastic type of Egypt. Certain it is that so far we have found no suggestion of the Cromagnon type of Europe in either the prehistoric people of North Africa or of Palestine.

CHAPTER XIV

THE CAVES OF MOUNT CARMEL

THE reader will see that there is a parallelism between the prehistoric events of Palestine and of France. In France the Mousterian culture and Neanderthal man disappeared together; they were replaced by a neanthropic race which brought with it the Aurignacian culture. The evidence of Shukbah cave, so far as it goes, points to a similar sharp transition. We have to remember, however, that a long interval may have elapsed between the early occupation of Shukbah by the Neanderthalians and the coming of the Natufians. Between these two periods of occupation there may be missing the records of transitional periods. In Shukbah there may be omitted not only cultural strata which are older than its Capsian deposits, but also others which are later. If prehistoric events followed the same sequence in Palestine as in France, then we ought to find somewhere between the Valley of the Jordan and the coastal plain, caves containing records later than the Capsian of Shukbah. Such records would represent the final cave cultures of Europe—the Magdalenian and Azilian. In search of these missing records, we have now to move the scene of our inquiries northwards from Shukbah in the Judean hills to Mount Carmel—Elijah's country.

Our route lies along the coastal plain (fig. 61). Leaving Lydda, a railway journey of 60 miles carries us to the northern end of the fertile plain of Sharon. Here our way to the Bay of Acre beyond is blocked by Mount Carmel, which ends as a high promontory and causes the railway to hug the shore before it reaches Haifa, the busy port on the Bay of Acre. On the coast 6 miles south of the Carmel promontory is the stronghold of Athlit, built by Crusaders in the twelfth century. The traveller who alights at the railway siding at Athlit has an extensive view of Carmel. The great limestone ridge, extending inwards for 15 miles, rises to a height of 1700

feet, and sends its south-western slopes down to end in cliffs and ravines on the edge of the narrow plain of Sharon. The heights are green with pines; there, where Elijah and his servant sojourned in the reign of King Ahab, 850 years before the birth of Christ, are now European hostels, but the grey cliffs and caves which abut on the narrow belt of plain, separating the foot of Mount Carmel from the sea, are much to-day as they were in Elijah's time. If we leave Athlit and cross the plain in a south-easterly direction amid fields tilled by Arabs and by Jewish settlers, a walk of two miles brings us to the mouth of the Wady-el-Mughara, "the valley of the cave", which here opens from the slopes of Mount Carmel. Just as we enter the ravine, we find on our right a grey cliff some 60 feet in height. At the foot of the cliff a vast cave opens; its mouth has been partly closed by a rubble wall. As a visitor approaches and climbs the platform or terrace which has accumulated at the foot of the cliff and in front of the cave he has to climb the wall to enter the cave. On entering, the visitor finds an ample and lofty chamber; at its widest the cave measures 60 feet, and nearly as much from front to back. Behind opens out a spacious hinder chamber; from the hinder chamber a passage runs backwards into the bowels of the limestone cliff. Such is the situation of the Athlit cave in the flank of Mount Carmel.

Towards the end of 1928 plans were afoot for extending the harbour of Haifa, and the engineers, looking round for stone, lighted on the limestone cliffs which sheltered the Athlit cave. This brought the Department of Antiquities of the Government of Palestine on the scene. It was known that several caves in the western slopes of Mount Carmel had been inhabited in palaeolithic times; they had been tentatively explored by several archaeologists; fossil bones of animals and the implements of cave men had been found. There was a danger that quarrying operations might destroy the caves and their records. Hence in December 1928 the Director of Antiquities caused a trial trench to be cut in the platform

in front of the Athlit cave, and also another in its floor. In the bottom of this trial trench, at a depth of 4 feet, the explorers opened a palaeolithic seam, one containing such a combination of objects as might well quicken the pulse even of an experienced archaeologist. The flint implements were microliths of the "late" cave period; bone points, bone needles and bone pendants lay in the same seam. There were, however, two strange objects: one was the shoulder-blade of a deer, perforated so as to resemble the "arrow-straighteners" of the Eskimo and the *baton-de-commandement* of the late cave men of Europe. The second object was still more remarkable. It seems to have served as the haft of some kind of dagger; at least, it is so fashioned as to answer admirably to the grasp of the human hand. It has been made from a limb bone—probably the humerus of a deer; it is now in a mineralized state and smooth. In its original state such a bone has an enlarged extremity or head. Out of this some cave artist has carved the image of a fawn. The head, thrown back, with full eyes and broad muzzle, is set on a curved neck. Head and neck are realistic and carved in the round, but the body, which straddles the end of the haft, and the hind and fore limbs which descend on it and give security of grip are carved in relief. Such a combination of objects—microliths, bone points, perforated scapula and sculptured bone—finds its nearest analogy in the final palaeolithic cultures of the caves of Europe. The preliminary trenches dug at Athlit seemed to indicate that in Mount Carmel were to be found some of the later strata which were absent in deposits at Shukbah.

The exploration of the Athlit cave was committed by the Department of Antiquities to the British School of Archaeology in Jerusalem, and the Director of the School, Mr. J. W. Crowfoot, who had succeeded Professor Garstang, invited Miss Garrod to carry out the excavation. Hence, in the spring of 1929, it came about that Miss Garrod, in place of returning to complete the excavations at Shukbah, pitched her camp in the mouth

of the Wady-el-Mughara, in the rough ground at the foot of Mount Carmel just below the cave of Athlit. She recruited labour—men and women—from neighbouring Arab villages built on the craggy slopes above the plain, and, before the heat of high summer brought the season's work to a close, she and her able staff had made an exact and systematic examination of a large part of the cave. As usual there had been disturbances, and only by the exercise of the greatest care was it possible to follow the

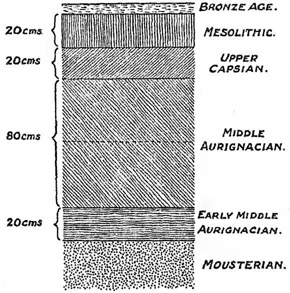


FIG. 65.—A diagrammatic representation of the succession of strata found in the excavation of the Athlit cave, Mount Carmel.

exact sequence of strata—the greater part of which were intact and remained as cave man had left them. As excavations proceeded it became apparent that Athlit cave had been occupied by man from a very remote period, and that the strata of its floor carried the records of successive races of mankind and of various periods of palaeolithic culture.

In fig. 65 I have taken the liberty of throwing into the form of a diagram the succession of strata encountered by Miss Garrod in the floor of the cave at Athlit.[1] As in the Robbers' cave, Galilee—which is 35 miles distant—and in Shukbah in the Judean Hills, the deepest and

[1] See *Man*, 1930, vol. 30, p. 77.

oldest stratum was laid down in the period of Mousterian culture, but up to the end of the 1930 season no human burial had been found in it, only flint implements typical of the culture.[1] Then followed above the Mousterian level a stratum, only about nine inches in depth (20 cm.), which contained a totally different culture—allied to the oldest of the middle Aurignacian industries of Europe. Over it there lie two strata, with a combined thickness of rather more than 2½ feet (80 cm.), both containing flint implements similar to the "middle" Aurignacian of France—the culture of the tall Cromagnons. Then follows a thin stratum containing an upper or late Capsian (Aurignacian) culture. This in turn is succeeded by the largest and latest palaeolithic representation of the cave—that which was tapped by the trial trenches and gave the remarkable objects already enumerated.

This cave in Mount Carmel, then, had been a popular residence for man at many stages of palaeolithic culture—the culture of the cave man; the cave at Athlit supplies records which are missing in the Robbers' cave and at Shukbah. These in turn supply records which are missing at Athlit. The Middle Aurignacian cultures which follow the Mousterian in Athlit (fig. 65), and perhaps the Capsian as well, are older than the Capsian of Emireh and of Shukbah. These have to be interpolated in the Athlit strata between its Capsian and its mesolithic deposits (fig. 65). The mesolithic culture of Athlit indicates a period of transition leading from a palaeolithic to a neolithic culture. Students of palaeolithic industries find in the cave strata of Palestine evidence of northern as well as southern influences. It does look as if Palestine, in palaeolithic times, had been much what she is to-day, and has been at all periods of history, a buffer or intermediate state, situated between two contending cultural zones and peoples. In the cave period an Aurignacian zone lay to the north, with its centre apparently in Asia, whence it overflowed into Europe. A Capsian zone lay to the south, with headquarters in North Africa. We can best interpret

[1] One lower molar was obtained; it was of the Neanderthal type.

the records of the Athlit cave when we make such presumptions.

Our immediate interest in the cultural strata of Athlit cave lies in the information they supply concerning the prehistoric occupants of the caves. So far its Mousterian stratum has yielded only a molar tooth, and with that evidence together with the information of the Robbers' cave and of Shukbah before us we cannot doubt that if human bones are found they will prove to be of the Neanderthal type. In the deposit which immediately follows the Mousterian—Lower

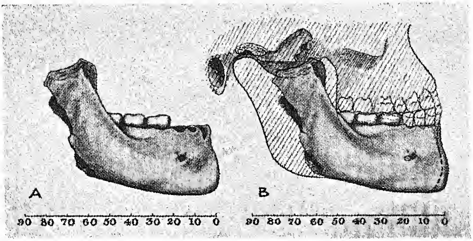


Fig. 66.—(A) Right half of a lower jaw from a lower middle Aurignacian stratum of Athlit, oriented in true profile. (B) The above superimposed on lower jaw of skull shown in figs. 67, 68.

Middle Aurignacian (fig. 65)—Miss Garrod was so fortunate as to find two lower human jaws. One is of an adult; the other of a child. The adult jaw is depicted in fig. 66, A, and the expert eye will recognize at once there is in it no Neanderthal trace; it is neanthropic in every detail. In Palestine, then, as in Europe, there was no transitional type of humanity; Neanderthal man and the Mousterian culture disappear; modern man, practising another culture, takes his place. The later Aurignacian strata (fig. 65) unfortunately contained no bones of the authors of the contained cultures. But in the uppermost or mesolithic strata of Athlit Miss Garrod recovered a

series of burials. Graves seem to have been dug irregularly; the dead were apparently buried in a haphazard manner and the earth over their bones trampled underfoot. As in the Capsian deposits at Shukbah there were many fragmentary remains. In some cases limestone blocks were grouped round a grave. The dead were of

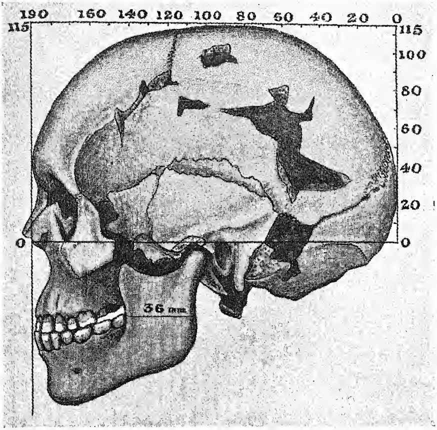


FIG. 67.—Profile of man's skull from the Capsian deposits of the Shukbah Cave.

all ages; the skeletons of children were more numerous than those of adults. In physical type the late cave people of Athlit were the same as the Natufians of Shukbah.

An elaborate comparison of the human remains found by Miss Garrod in the Capsian deposits of Shukbah with those from the Aurignacian and mesolithic deposits at Athlit has led me to the conclusion that all represent the same racial stock. The skull from Shukbah, depicted in

figs. 67, 68, may be accepted as a type. Especially remarkable was the nasal development of this cave people—often almost negro-like in the flattening of the nasal bridge and in the width of the inter-orbital septum. The nasal bones, although their transverse arch is depressed, still have remarkable dimensions—such as

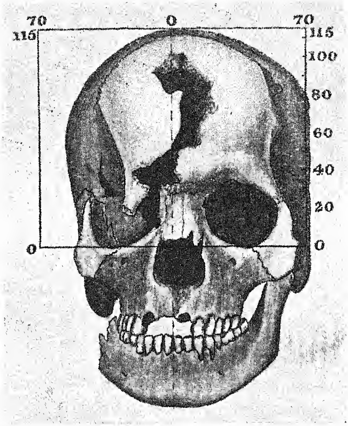


FIG. 68.—Full-face view of the Shukbah skull shown in Fig. 67. The upper right incisor had been extracted in youth.

might herald the pronounced nasal development of later Semitic races (figs. 67, 68). The nasal bones of the skull shown in fig. 68 have a minimal width of 15 mm. and form an arch only 2 mm. in height. The inter-orbital septum is 30 mm. wide. The great gash which opens the forehead (fig. 68) has on its sides marks made by a heavy cutting implement.

Although only three of the larger caves of Palestine have been explored, yet their cultural strata have such a

degree of resemblance to those of Europe, both in sequence and in form, that we may safely infer that there was also a correspondence in time. The evidence, as it stands at present, leads us to believe that the period of Mousterian culture in Europe came to an end as the last great glaciation moved to its climax, and that it began or was initiated in Europe during the long temperate interval which preceded the last glaciation. Palestine was subject to different but contemporary climatic changes. When northern Europe lay under ice Palestine was wet and fertile; when Europe basked in the sun, Palestine became arid and hot. The evidence of the Mousterian strata of Palestine indicates that they were laid down when game was plentiful and when the land was well watered. It is probable, then, that the Mousterian deposits in Galilee, the Judean Hills and in Mount Carmel correspond to the later Mousterian of Europe, but even then we must attribute to its last phase an antiquity of over 20,000 years. The culminating palaeolithic cultures of Europe were—Aurignacian, Solutrean, Magdalenian and Azilian. Perhaps it would be better to reckon the last not among the palaeolithic cultures, but as the first of the mesolithic. All of these we regard as having flourished at varying phases of the last great glaciation. We regard them as extending over a period of 10,000 years at least, thus bringing human history down to a point some 10,000 years before the Christian era began. We are justified, I think, in applying the same time scale to the cave cultures of Palestine. In the meantime I regard the post-Mousterian strata of the cave in Mount Carmel—the pre-Capsian, the middle and upper Aurignacian, the Capsian of Emireh and of Shukbah and finally the upper Capsian or mesolithic of Athlit—as contemporary with the late ice age cultures of Europe, and, like them, extending over a period of some 10,000 years. If this interpretation is accepted, then we must regard palaeolithic cave history of Palestine as coming to an end about 10,000 B.C. The human remains found in the most recent deposits at Athlit represent the last of the true cave men of Palestine, and

the highest point attained in culture is represented by the objects found in the stratum which contained their bones. We have still to discover when and where man first came by a knowledge of agriculture and thus laid the basis of modern civilization.

CHAPTER XV

'TWIXT THE DARKNESS AND THE DAWN

IN the previous chapters we have been attempting to trace the footsteps of the prehistoric inhabitants of Palestine down the stream of time. We have followed them to a point which we presume to be about 10,000 years before the Christian era began. Having reached this point we come to a standstill; cave man vanishes, leaving no certain trail behind him. We have not yet discovered the path which led man from the cave to the village. When next we come across the Palestinians they are members of settled communities—tillers of the soil, raisers of cattle, spinners, weavers and makers of earthenware. If we are to discover the long series of events which transformed predatory hunters into law-abiding citizens, we must alter our mode of approach. Instead of tracing events down the stream of time, we must do the opposite. We must seek out the oldest traces of civilization known to us and see how far back they will take us. For this purpose we must carry our search to Egypt on the one hand, and to Mesopotamia and the lands beyond on the other. Even when we have followed prehistory backwards in these lands, as far as the explorer's spade has yet taken us, we shall find there is still a vast uncharted gulf to be crossed before we can link cave-life to village-life. In 1924, when surveying the evidence relating to the earliest traces of civilization then available,[1] I had to give Egypt pride of place. Egypt's dynastic history began more than three thousand years before the birth of Christ; the date accepted by most historians is 3300 B.C. In 1895 Sir William Flinders Petrie opened an ancient cemetery at Naquada (fig. 69) which proved to belong to a still older period—the predynastic. Later discoveries made it necessary to regard the predynastic period as a long one; a provisional estimate assigns to it a duration of 1200

[1] *Antiquity of Man*, vol. i, chapter ii.

years. On this scale of reckoning the predynastic period of Egypt began about 4500 B.C. and came to an end about 3300 B.C., when Upper and Lower Egypt were united under Menes. In 1924, the early predynastic cemeteries and settlements of Egypt provided evidence of the oldest communities then known to archaeologists. There was, however, as I mentioned then, one possible exception—the graves and sites which were being ex-

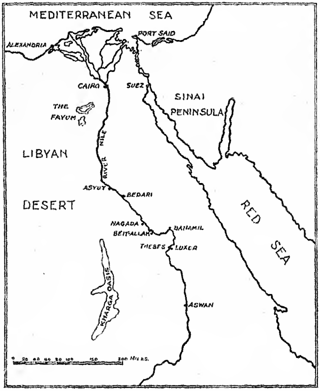


FIG 69.—Sketch map of Egypt to indicate sites of discovery mentioned in the text.

plored by Mr. and Mrs. Guy Brunton in the Badari district on the eastern bank of the Nile, just within the limits of Upper Egypt (fig. 69). Their explorations were conducted under the aegis of the British School of Archaeology in Egypt, of which Sir William Flinders Petrie was then and still is the moving spirit—although the School had to abandon exploration in Egypt. By 1925 it was definitely proved that in the Badari district there were cemeteries and sites of villages which were

older than those of the early predynastic people. Mr. Brunton is convinced that the Badarian culture must have lasted several centuries; he has made a provisional estimate of 500 years, thus carrying the archaeological history of Egypt back to a date of about 5000 B.C. The British School of Archaeology having transferred its operations to Palestine, Mr. and Mrs. Brunton, convinced of the importance of Badari as a treasury of ancient things, returned to Egypt on their own account. Two seasons' work—1927–28, 1928–29—was crowned by the discovery of a still older culture for which the name "Tasian" has been proposed by its discoverer. Mr. Brunton has given the tentative dates 5500–5000 B.C. as marking the period of the "Tasian" culture. Thus between 1924 and 1929 the excavator's spade carried the history of Egypt one thousand years farther back, but even at this early time the Egyptians were a settled people, living in villages, sowing, reaping, grinding, spinning, weaving and making pottery of the highest finish.

The traveller who ascends the Nile begins to reach the scenes of Mr. Brunton's discoveries 20 miles above Asyut, which town is 200 miles from Cairo as the crow flies. In the Badarian stretch of the Nile the bare hills on the eastern bank encroach on the valley so that only a narrow strip of land is left for irrigation and cultivation. Between the irrigated fields and the foot of the hills there is a wide terrace—a belt of low desert. This belt had not always been a sandy, stony waste, for under the present surface near the cliffs occur the roots of trees. At the same level occur the sites of ancient villages. Mr. Brunton concentrated his attention on this narrow fringing belt of desert which occurs at many places along the east or Badarian bank of the Nile. His excavations brought to light cemeteries of all ages—dynastic, predynastic, Badarian and Tasian. At first the greater antiquity of the Badarian culture was merely a surmise, but a discovery made by Miss Caton-Thompson, working with Mr. Brunton for the British School, turned surmise

into fact. She excavated a site in which stratified deposits of the Badarian culture were buried beneath deposits which contained objects characteristic of the early predynastic culture. Later Mr. Brunton found graves dug by Egyptians of the early predynastic period; the digger had cut through a stratum containing objects typical of the Badarian culture. When the British School of Archaeology in Egypt brought its last season's work to an end (1924–25) it had excavated 250 Badarian graves and recovered the remains of over 60 adults.

What kind of people were the ancient Badarians? Their skulls, collected by the British School, were entrusted for examination to Miss B. N. Stoessiger of the Biometrical Laboratory, University College, London, and a full report of her measurements has been published.[1] Badarians differed in no essential respect from their successors the predynastic Egyptians. They were a lightly made people of short stature and with small heads. The mean length of the male skull was 182 mm., its width 131, the width being just under 72 per cent. of the length. They were long-headed—dolichocephalic; the vault of the skull was low, its height above the ear passages being 111 mm. Their noses were short (42·2 mm.) and relatively wide (24·9 mm.). The cranial capacity of the male skulls was 1370 c.c., that of the female 1274 c.c.—almost the same as the means for their successors, the predynastic Egyptians. Nor is the type dead. Dr. Alěs Hrdlička[2] measured natives of the Kharga Oasis, which is 130 miles distant from Badari (fig. 69) and situated in the desert of the opposite (western) bank. If allowances are made for the flesh, the head, face and body measurements of the living Khargians differ from those of the ancient Badarians only in matters of detail. The excavations of the Badarian sites and cemeteries, although they brought to light an unknown culture, produced no strange type of humanity.

1 *Biometrika*, 1927, vol. xix, p. 110.

2 Dr. Alěs Hrdlička, "The Natives of the Kharga Oasis", *Smithsonian Publications*, 1912, vol. 59, No. 1.

Mr. Brunton also recovered three skulls from graves of the still older people—the people of the Tasian culture. Their culture is distinctive—they fashioned and used small polished stone axes; their beakers might well have served as the prototypes of the vessels shaped some three thousand years later by the "beaker people" of Europe. They differed from the Badarians, not only in their culture, but also in their physical characters. When in Egypt in the spring of 1930, Professor Derry of Cairo showed me three of these Tasian skulls. Although of about the same length as the Badarian, yet they are much wider and higher. The face of the Tasian was longer, features more European and chins better developed. Indeed, they recall a type which did not become common in Lower Egypt until a later date—in the early dynastic period. Whether they represent a local development of the predynastic type or are an immigrant people cannot be determined on the evidence now available.

When making my last survey of the prehistoric human remains of Egypt, I was under the impression that the only human type which had been found in predynastic graves was that which I have just described in connection with the Badarian culture. Dr. G. M. Morant, in a recent publication,[1] has called attention to certain predynastic cemeteries excavated by M. de Morgan in Upper Egypt. An account of the people and of their culture was published so long ago as 1897.[2] These cemeteries were situated on the fringe of the desert above and below Abydos, on the western bank of the Nile at no great distance from the Badarian sites (fig. 69). The skulls from these cemeteries were measured and described by Dr. D. Fouquet.[3] The people buried in these cemeteries differ altogether from the Egyptians—both predynastic and dynastic. They were a big-headed folk; the mean length of the male skull was 188 mm.—6 mm. more than that of the usual predynastic male;

[1] "Study of Egyptian Craniology from Prehistoric to Roman Times", *Biometrika*, 1925, vol. xvi, p. 1.

[2] *Recherches sur les Origines de l'Egypt*, vol. 2.

[3] *Ibid.*, vol. 2, p. 269.

its width was 139 mm.—8 mm. more than the predynastic mean. Their skulls were also lofty, with a cranial capacity of 1476 c.c.—100 c.c. above the predynastic mean and about equal to that of the average Englishman of to-day. They were long-faced and strong jowled. We cannot explain such characters by supposing that the people buried in the predynastic cemeteries opened up by M. de Morgan represent a highly specialized local type. The only reasonable explanation is to suppose that already in predynastic times a foreign people had found their way to Egypt and settled there. When we look round for the homeland of such a long-headed, big-brained people, it is not towards the south but towards the north or north-east that we look. It may have been some country in the Mediterranean basin which was their homeland, for in late palaeolithic times people of such a type were there. More probably, however, they came from the lands between the Mediterranean and India, for, as we shall see, people allied in type to the big-headed predynastic Egyptians are to be found buried in the early Sumerian graves of Mesopotamia.

Thus we can trace men backwards in Egypt—by cemeteries, sites of villages and human remains—to a date some five and a half millennia before the Christian era began. In the caves of Palestine we have traced human history down to a date which is believed to be about 10,000 B.C. If these reckonings are right, or approximately right, there still remains a period of some 4000 or 5000 years to be accounted for. No doubt this blank is filled to some extent by discoveries made by Miss Caton-Thompson[1] in the Fayum (fig. 69). On ancient shore lines of the lake which filled the depression in neolithic times she discovered two cultures, which show kinship to the Badarian on the one hand and to the latest cave cultures of Palestine on the other. The ancient dwellers in the Fayum had already come by a knowledge of agriculture, while the cave people of

[1] Gertrude Caton-Thompson and E. W. Gardner, *Geographical Journal*, 1929, vol. 73, p. 20.

Palestine had no such knowledge; they were entirely dependent on Nature's bounties for their food and raiment.

Discoveries made by Messrs. Sandford and Arkell[1] in 1928–29 make it highly probable that we shall find in the beach deposits of the Fayum all the evolutionary stages which lead from palaeolithic times to the present. They succeeded in following a gravel terrace on the western side of the Nile Valley, one situated 25 feet above the present level of the river, into the basin of the Fayum, where it became continuous with a beach of the ancient lake. The terrace represents the Mousterian bed of the Nile, for in its gravels are found the implements of that period. These implements are also found in the Fayum beach with which the Nile Terrace becomes continuous. Now the beach which Miss Caton-Thompson explored, and which marked the level of the lake in earliest neolithic times, lies 74 feet below the Mousterian beach. Between the Mousterian beach and that of the early neolithic period there is a series which Messrs. Sandford and Arkell discovered to be of upper palaeolithic and mesolithic dates. Thus in the great circuit of the Fayum, just as in the caves of Palestine, there are preserved records which begin in Mousterian times and end, not like the cave records in mesolithic times, but long after the kingdoms of Upper and Lower Egypt had become united under one crown. The sites on which the later palaeolithic inhabitants of Lower Egypt lived have become buried deep below the silts which have accumulated in the Valley of the Nile, whereas they are still open to excavation round the basin of the Fayum.

In this chapter we are searching for the steps which led mankind from cave-life to village-life. All that Egypt has done for us is to convince us that these critical steps were taken by man long ago—well before the sixth millennium B.C., but where they were taken and who took them we have still to discover. Let us, then, turn for the

[1] *Palaeolithic Man and the Fayum Nile-Divide,* University of Chicago Press, 1929.

latest information which bears on our search to lands which lie to the east of Palestine—to that important central area of the old world which extends from the Mediterranean in the west to India in the east and from Arabia in the south to Turkestan in the north. It is in this region of the earth that we are most likely to find the cradle of our civilization, and it is a vast cradle measuring about 2000 miles from east to west and from north to south. Since 1924 certain discoveries have been made which throw a new light, not only on the antiquity of our civilization, but also on the early origin of the Caucasian type of humanity by which the first critical steps seem to have been taken. In the first place there has been the exploration of the foundations of the ancient city of Ur (fig. 70) by a joint expedition fitted out by the British Museum and the Museum of the University of Pennsylvania and led by Mr. C. Leonard Woolley.[1] In the second place there has been the exploration of the site of Kish—which was a vast city—by an expedition sent out by two Museums, the University Museum, Oxford, and the Field Museum, Chicago, under the leadership of Professor S. Langdon of Oxford.[2] In the third place there have been discoveries of buried cities, quite as ancient as the oldest cities of Mesopotamia, in north-west India. These discoveries have been made at Mohenjo-Daro, on the plain of the lower Indus, just under the hills of the Beluchistan frontier, and at Harappa, in a desert region of the Punjab which lies between Moltano and Lahore. These forgotten cities were brought to light and excavated by the Archaeological Department of the Government of India under the directorship of Sir John Marshall.[3] From such sources we are assured that more than three thousand years before our era began,

[1] An account of the excavations carried out between 1919–1925 will be found in *Ur Excavations*, vol. i, *Al-Ubaid*, by H. R. Hall and C. L. Woolley (issued by the Oxford University Press for the British Museum), 1927.

[2] *Excavations at Kish*, vol. i, 1924.

[3] Preliminary accounts of the excavations at Mohenjo-Daro and at Harappa have appeared in the *Illustrated London News*, September 20, 27, October 4, 1924; February 27, March 6, 1926; January 7, 14, 1928.

the inhabitants of lands so far apart as Mesopotamia and India had passed from a village-stage to a city-stage of existence. Men can live in cities only when they have brought all the arts and crafts of civilization to a high state of proficiency and have established commerce on

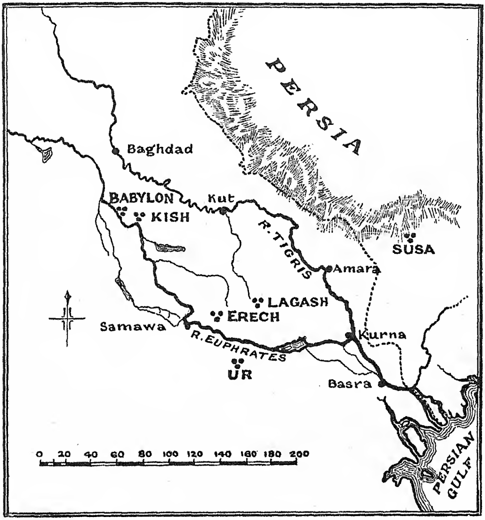


FIG. 70.—A sketch map of ancient Mesopotamia.

a wide and sound basis. Clearly the men and women who built and occupied cities in eastern lands during the 4th millennium B.C. had left far behind them the life led by the cave dwellers of Palestine. Clearly, too, modern civilization has a long history; we must postulate a remote date for its beginnings. When we seek to carry the beginnings of human civilization in the East back to

so early a date as 10,000 or 12,000 B.C.—when Europeans were still in the later stages of the palaeolithic culture—we do not make too big a draft on the bank of time. But as yet we have no balance to meet our drafts. There is in Mesopotamia, as in Egypt, the same unbridged gap between the cave-phase and the village-phase of prehistory.

Of the prehistoric sites in South-Western Asia, the most remarkable is Susa, a stronghold of the ancient Elamites. It is situated at the western foot of the Persian highlands, on the border of the great alluvial plain drained by the Tigris and Euphrates (fig. 70). The deepest stratum of the mound which marks the site of ancient Susa contains the earliest evidence known to us of civilization in Asia. This was the position held by Susa when I made my last survey in 1924, and, in spite of many recent discoveries, it still maintains its unique position in the scale of antiquity. Indeed, the excavations made lately at Kish and at Ur have only served to show how very long ago it is since the Elamites made Susa into a stronghold. In the opinion of leading authorities such as Dr. Henri Frankfort[1] and Professor V. G. Childe[2] the culture of the early Elamites was more elaborate and just as old as that of the earliest predynastic villagers of Egypt. They were agriculturists as well as warriors; they still used stone implements, particularly the polished celt or axe, but they had also copper and knew how to use it. They were master-potters; they made a painted kind of earthenware of exquisite workmanship. Their pottery has become an archaeological landmark; excavators of Eastern sites know that when they have struck a stratum which contains it, they have reached an ancient level—one which may be dated 4500 B.C. or earlier. Unfortunately we know nothing of the founders of Susa; not a bone of their body has been described. Possibly we have not yet discovered the real sites of their cemeteries. However this may be, it is most probable they were akin to

[1] Royal Anthropological Institute: *Occasional Papers,* No. 6, 1924.

[2] *The Most Ancient East,* 1928.

the people who settled in the lowlands and marshes between the Tigris and Euphrates and there established the cities of Sumer and of Accad—Sumer lying to the south of Accad. Those who have sought to unravel the histories of the oldest cultures of Mesopotamia trace them to the homeland of the Elamites, the mountainous regions which lie to the west and to the north of Mesopotamia. Having, then, no remains of the Elamites to tell us what kind of men founded the ancient civilization of the East, we have to fall back on the earliest inhabitants of the plain known to us—the Sumerians unearthed by Mr. Woolley at sites in and near Ur of the Chaldees (fig. 70).

In fig. 71 I have taken the liberty of showing in a diagrammatic way the discoveries made at Ur by the expedition working under Mr. C. Leonard Woolley. The diagram is based on data published by him at the close of the season 1928–29. At the top of the diagram is represented the wall which enclosed the Temenos or temple built by Nebuchadnezzar, 600 B.C. Digging into the foundations under the Temple enclosure, graves of commoners were encountered; the cultural objects found in the graves dated them; they were of the time of Sargon, the first Semitic ruler of Accad, 2700–2600 B.C. Still deeper graves were found—also of commoners; they were older than the 1st dynasty of Ur, before 3100 B.C. We may regard the people buried in them as contemporary with the Egyptians of the 1st dynasty. Still deeper, 30 feet below the level of the sacred enclosure, were discovered the most amazing and awe-inspiring graves of ancient times. They were the graves of kings and queens and of their retinues. Great pits had been dug, so large that the Royal wagon drawn by a team of oxen or in some cases asses, attended by grooms, could enter and take up their stations. Not only were there wheelwrights in Ur when these royal graves were dug about 3500 B.C., but the chamber or mausoleum erected in the pit proves that its architects knew how to build arches and domes. Into the pit, following

their dead sovereign, marched the court in full regalia—courtiers, armed and in uniform, ladies-in-waiting clad in their best, guards, men servants and maid—and there laid themselves down in death to accompany their dead leaders. Those ancient Sumerians had a faith and courage

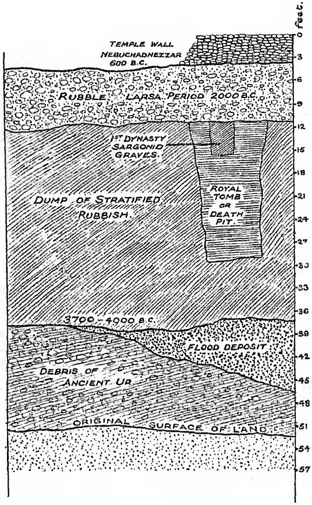


FIG. 71.—A diagrammatic section of the cemetery and foundations of Ur. (After C. L. Woolley.)

as to what death holds in store which the world no longer knows. Alas! time has dealt cruelly with their remains. The weight of 30 feet of superincumbent material, pressing on their bones for over five thousand years, has crushed their skulls and eaten away the softer substances of their bones, so that complete restoration of the persons of the ancient Kings and Queens of Ur is not possible.

Still, enough remains to tell us what kind of people they were. It was otherwise with the precious things which were transferred with the dead king from palace to mausoleum. By the application of patience and a perfect technique, Mr. and Mrs. Woolley have succeeded in restoring to dress, ornaments and utensils their virgin splendour.

The men who ruled in Ur in the latter half of the 4th millennium B.C. did not know that their mausoleums were being dug in a rubbish dump; that was a discovery made by Mr. Woolley during the excavations of A.D. 1927–28, 1928–29. The site of the cemetery at Ur lies to the south and east of the most ancient part of the city; the graves had been dug, not in the original soil of the plains, but in "made" ground which had been reclaimed from marsh by inhabitants of Ur some considerable time before the middle of the 4th millennium B.C. In ancient Ur it was the custom, as in modern cities, to set aside a place where rubbish and dust could be tipped and land reclaimed. In the course of time the reclaimed land of Ur provided the site of a cemetery, first for kings and much later for commoners. Thus it came about that the soil in which the graves were dug, and which extends to a depth of 40 feet under the Temenos of Nebuchadnezzar, contains shards, seals and other objects which are far older than the oldest graves; they represent the culture attained by Ur before or about the date 4000 B.C.

Under the cemetery and the rubbish-tip of ancient Ur Mr. Woolley made another discovery. Here he came across a uniform stratum or deposit of clay and mud some 8 feet in thickness. Such a deposit was clear evidence of a flood; mud-laden waters must have accumulated on the plain some time before the date 4000 B.C. and deposited their burdens on the marsh which was later to become a burial place for kings. All the plain had not been submerged, for further excavation revealed, as is shown in fig. 71, that the flood-stratum was laid down on the side or shoulder of a mound or island. On

this mound were found evidences of a still older culture, one which contained fine painted pottery—not quite the genuine article of ancient Susa, but one closely akin to it. Thus before the flood there was a city of Ur; the prediluvian city must have been in existence near the beginning of the 5th millennium B.C., being therefore contemporary with the earliest predynastic villages of Egypt or perhaps even those of Badarian period. Hence in our search for the beginnings of human civilization, in Mesopotamia as in Egypt, we are compelled to realize that we have to go a long way back. At Susa and at Badari we are well within the 6th millennium B.C. and yet we seem as far short of the real initial steps as ever.

In 1919 the British Museum, taking advantage of the more settled conditions which had been established in Eastern lands after the Great War, sent an expedition under the late Dr. H. R. Hall to excavate the great mound in the desert which marks the site of Ur. One Sunday morning, soon after his arrival, Dr. Hall rode westwards from Ur until he reached a mound known as Al-'Ubaid, about 4 miles distant. In the surface sands on and around the mound he observed many shards of fine painted pottery, arrow-heads, flaked flints and other objects which told him that he was on a site which had been occupied by the earlier marsh-dwellers. He excavated the mound and found it covered the ruins of three temples, the oldest built in the first dynasty of Ur, about 3000 B.C. In 1922–23 Mr. Woolley, having taken Dr. Hall's place, began the excavation of an elevated area which lay to the south of the greater mound at Al-'Ubaid and found in it the debris of hearths, of houses which had walls of reed-matting plastered over with clay or bitumen and placed between supporting posts—a mode of house-building still practised by the poorer people of the plains. The ancient inhabitants of Al-'Ubaid were agriculturists and also fishermen. Mr. Woolley found their stone hoes, sickles of pottery and querns; he found their fishing hooks and models of their boats. It will be remembered that he found deep under

the foundations of Ur a mound or island which had been a settlement in prediluvian times (fig. 71). The village of Al-'Ubaid appears to be of the same date as the prediluvian settlement at Ur.

Extending his excavations on the village mound, Mr. Woolley exposed a cemetery and examined the contents of 94 graves. Two of the graves contained vessels of fine painted pottery still intact; the pottery had survived, but alas! the dead had vanished; their bones had melted into

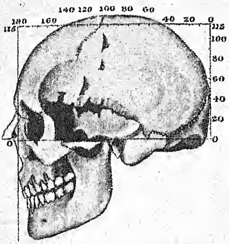


FIG. 72.—Profile of a male skull (C.56) from the ancient cemetery at Al-'Ubaid —*circa* 3100–3000 B.C. The skull is set on the Frankfort plane.

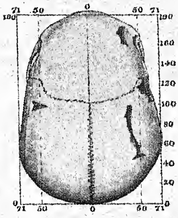


FIG. 73.—A view of the vertex of the skull shown in Fig. 72, oriented on the Frankfort plane.

the soil. Other graves were of a later date—of the first dynasty of Ur—people who had lived when the oldest temple at Al-'Ubaid was built. From these graves Mr. Woolley succeeded in rescuing the remains of 17 individuals—9 men, 6 women, a youth of 18 and a child of 7. Five of the men's skulls and three of the women's were approximately complete.[1]

What kind of people were these Sumerians who lived at Al-'Ubaid in the 1st dynasty of Ur towards the end of the 4th millennium B.C.? In fig. 72 is represented the

[1] For a description of these remains, see *Ur Excavations*, vol i; *Al-'Ubaid*, part ii; *The Cemetery*, by C. L. Woolley and Sir Arthur Keith, 1927.

profile of one of the men's skulls from Al-'Ubaid; it illustrates the chief racial features of the Sumerians. The skull is oriented on the Frankfort plane and placed within a framework of lines, erected on that plane O, O. The skull I have chosen is of too large dimensions for the framework; in place of being 190 mm. long it is 194 mm.—12 mm. more than the mean for the skull of predynastic Egyptians. Nor is the length of this skull exceptional; the mean for the five measurable male skulls was 192·8 mm. The roof of the skull is particularly high, rising 123 mm. above the Frankfort plane and 110 mm. above the subcerebral plane; the mean for the five male skulls was 119·6 mm. As will be seen from the vertical view given in fig. 73, the skull, although elongated and dolichocephalic, is of medium width—143 mm. The prevailing type, however, was narrow, the mean for the five being 140 mm., the width being 72·6 per cent. of the length. The Sumerian head was long, big, but relatively narrow; it was strongly dolichocephalic. The mean cranial capacity of the five male skulls was 1488 c.c., about the same as in modern Englishmen and 100 c.c. more than in predynastic Egyptians. The facial features of the Sumerians were strongly marked. The forehead was crossed by very apparent supra-orbital ridges; the bridge of the nose, in several cases, continued the line of the forehead, as in the classical type of Greece. In nearly one half of the male skulls the nose attained a highly specialized development, one which is often exemplified by the skulls of ancient Romans. In fig. 74 is reproduced an exact drawing of a cranial fragment, almost all that remained in a grave to tell a man had

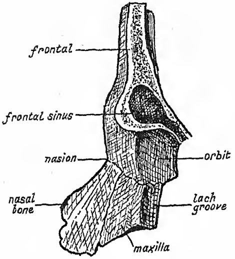


Fig. 74.—A drawing in true profile of a fragment of the forehead with the root and bridge of the nose attached. From grave C.40, Al-'Ubaid.

been buried in it. The drawing illustrates well the size and shape attained by the nasal bones amongst some of the ancient Sumerians. The same specialization in nasal growth is still to be seen amongst Eastern peoples and is often associated with strength of character when met with in Europeans. When such nasal features made their appearance in the human face we cannot tell; the specimens from Al-'Ubaid are the earliest yet discovered. Such a development of the nose is altogether a late human feature; the nasal bones of the ape are flat and sink into the general contour of the face.

The features of the Sumerian face were, as I have already observed, strongly differentiated. The chin was prominent, the jaws strong, the palate large. The length of the dental palate as measured in this work was 51·8 mm.—2 mm. more than in predynastic Egyptians and 3 mm. more than in the modern Englishman. The dental palate was also wide; the width between the outer borders of the second pair of molar teeth was 64·7 mm.—3 mm. more than in ancient Egyptians. The teeth, particularly the incisor teeth, were ground down by wear; caries was very uncommon, but abscesses at the roots of the teeth were to be seen in almost every jaw.

Among Eastern peoples one often observes individuals in whom the upper or nasal part of the face is long as compared with the total length of the face, measured from root of nose to lower border of chin. This was so in the Sumerian type of Al-'Ubaid. The total length of the face, if we make allowance for the extreme wear of the front teeth, was about 120 mm. or more. In a European face of such length we expect the nasal part to measure 51 mm., the upper jaw, from nasal sill to alveolar border, 19 mm.; the lower jaw or symphysis 35 mm. In the Sumerian the nasal segment measured 54 mm., the upper jaw 18 mm. and the lower jaw (symphysis) 35·7 mm. The nose was not only long but also wide, the mean being 25·7 mm. The cheek bones were not high nor the face wide; measured between the

outermost parts of the zygomatic arches the facial width was 127·6 mm.

It has been supposed that the Sumerians were a people with Mongolian affinities; no trace of such a relationship is shown by the Al-'Ubaid people. In size of skull, mass of brain, in nose, chin and facial characterization they differ altogether from the Mongolian type; they also differ from predynastic Egyptians. They were not a tall people—their mean height was under 5 ft. 5 in. (1650 mm.), but they were stouter made and more muscular than the Egyptians. Yet a type found in certain predynastic cemeteries of Egypt (p. 229) has many points of resemblance to the Sumerian of Al-'Ubaid. In dynastic times Sumerian features became more common in Egypt. If we search amongst living peoples for the Sumerian type we find its best representations among the Arabs; the modern Arab seems to be the degenerate descendant of the ancient citizens of the plain. The Sumerian features were not unlike those of the Afghan, but the Afghan head is usually brachycephalic. Round heads were not found at Al-'Ubaid or Ur, but Dr. L. H. Dudley Buxton[1] found them amongst the ancient skulls of Kish. In the eastern Jew, who may have a long head or a round one, we recognize a modification of the Sumerian type of countenance. As to the people of the early cities of India, we have as yet no information, but a skull from an early copper-age burial in Beluchistan described by Lieut.-Colonel R. B. Seymour Sewell[2] conforms to the Sumerian type.

It is clear that our visit to the sites of civilization of South-Western Asia has carried us into a field of humanity which differs profoundly from that of Africa. We here meet with big-headed men in whom facial features were strongly marked. We seem to be in the homeland of the pioneers of civilization. We are amongst Caucasians, for we must have a name to indicate a type of humanity which extends from India to Ireland and from Algiers

[1] Professor S. Langdon, *Excavations at Kish*, vol. i, 1924.

[2] "Excavations in Beluchistan", *Archaeological Survey of India Report*, 1929.

to Siberia. The Caucasian type has an infinite variety in its representation, yet through the variations runs a community of traits, amongst which I would include mass of brain, characterization of facial features and strength of body. At the present time men look askance on mass of brain, shape of nose, prominence of chin and strength of body as indications of racial or mental superiority. They find, when they apply such generalities to individual cases, that they are so often misled that they have ceased to believe in them. Yet the fact remains that such characters abound most in peoples and nations which are and have been in the vanguard of civilization; the majority of the leaders in every line of life in which progress is being made, are of this superior type. Certainly such a type abounded amongst the ancient Sumerians. I do not think that anyone who has compared the ancient Sumerians with the ancient Egyptians can hesitate as to which is the most likely to have been the pioneer of civilization. The archaeological evidence points to South-Western Asia as the cradle-land of civilization, and if the Sumerians were not the actual pioneers, it seems more than probable they were the descendants of the pioneers. It is for this reason I have entered thus fully into the discoveries made in Abraham's city—Ur of the Chaldees.

I am in danger of forgetting the main object I had in writing this chapter. It was to see how far back the archaeological records of Egypt and Mesopotamia would carry us towards the cave periods. Both lands carry us back to about an equal point in time, to the 6th millennium B.C. In both lands there is the same uncharted zone to be crossed before we pick up the threads of man's cave-life. Yet Egypt and Mesopotamia were inhabited in all stages of palaeolithic culture. I have already touched on certain aspects of the additions made to our knowledge of palaeolithic man in Egypt by Mr. K. S. Sandford.[1] In the valleys opening from the Nile Valley into the desert there are old terraces very similar in every way

[1] See p. 231.

to those of the Thames. The lower (50-foot) terrace of the Nile Valley was laid down in Mousterian times—when Neanderthal man occupied the caves of Palestine. At higher levels are the representatives of the Acheulean and Chellean terraces. In crossing and recrossing the Syrian desert—from Damascus to Bagdad—Mr. Henry Field[1] and Dr. L. H. Dudley Buxton came across abundant evidence to prove that the desert had been inhabited from early to late palaeolithic times, but found no bone or grave of the men and women who lived in a land which is now a waterless waste.

One other problem we have to leave unsolved. We have seen that Palestine was inhabited by the Neanderthal species of mankind. He was replaced by men of the neanthropic type in the later palaeolithic period. Where did this modern or neanthropic type come from? When was it evolved? The circumstantial evidence points towards that part of the earth we have been surveying—the south-western area of Asia, where later the early pioneers of civilization also made their appearance.

[1] "Early Man in North Arabia", *Natural History*, 1929, vol. xxix, p. 33.

CHAPTER XVI

THE UNVEILING OF ANCIENT CHINA

READERS of *Antiquity of Man* will remember a certain young French priest—Father Teilhard de Chardin—who figured in the discoveries made at Piltdown.[1] He was a distinguished pupil of those masters of prehistory, Professors Boule and Breuil, and came to England in 1913 to take part in the search for the missing parts of the famous skull. It was he who found the pointed canine tooth—half anthropoid, half human. In the Piltdown discoveries Father Teilhard was given only a minor rôle, but in those I am about to describe he takes the centre of the stage. Early in 1923 *l'Institut de Paléontologie humaine* resolved to open up a fresh field of inquiry. Ancient Europe had been searched and man had been traced through the pleistocene period right into the pliocene, representing an existence of some 300,000 or 400,000 years on our time scale. If Europe was inhabited throughout that long space of time, what was the state of ancient China and Mongolia—some 5000 miles distant—at the opposite or eastern end of the great continental mass? Were these distant parts of the old world also the scene of a succession of human types and of stone cultures? If inhabited, by what kinds of men? Was the succession of cultures the same in Eastern Asia as in Western Europe? When *l'Institut* sought answers to these questions it found only guesses, and it needed facts if the problems of human origin were to be solved. So in the spring of 1923 it dispatched Father Teilhard in search of facts. Circumstances favoured him. On his arrival in China he found waiting him Father Licent, Director of the Museum, Tientsin, who had already discovered most promising archaeological sites in that distant corner of China—the province of Kansu which marches with Tibet on the west and Mongolia on the north (fig. 75).

Let us look at the region where the two French

[1] Vol. ii, p. 664.

priests were to take up their search. It lies 500 miles to the west of Peking and is crossed by the Great Wall. The Hwang-ho issuing from the mountains of Tibet and of Kansu makes a great northern U-shaped bend on the flat desert plateau beyond the great wall, thus enclosing the region known as Ordos—equal in size to England (fig. 75). Ordos, 10,000 feet above sea-level, and the plateau lands of neighbouring regions, are everywhere covered by a great mantle of loess—here a yellow earth, varying in thickness from 50 to 200 feet. This deposit represents accumulations which resulted from the last great period of glaciation—the mud and sand carried

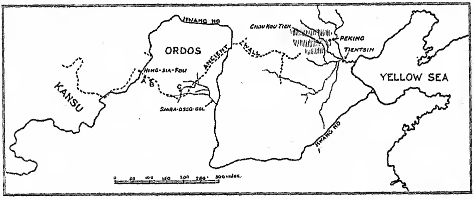


FIG. 75.—Sketch map of Northern China to show the sites at which prehistoric discoveries have been made. A, B, sites at Choei-tong-K'eou; C, site of the Sjara-osso-gol.

down by the floods from melting upland glaciers and the dust blown before the winds which swept the plateau in periods of drought and storm. The great mantle of yellow loess rests on an old land surface represented by the red pliocene earth below its base (fig. 76). The surface of the loess has become covered by a crust of dry black earth in which many traces of neolithic man occur. Clearly it would be a vain task to search for pre-glacial traces of human habitations in this region if archaeologists had to dig through 50 feet of loess, or more, before reaching the levels of man's ancient abodes. Here as elsewhere Nature has come to the aid of prying man; she has dug for them. Ever since the glacial mantle of yellow earth was laid down, side tributaries of the Hwang-ho have been cutting

into it, laying bare on the cliff-like sides of their ravines and valleys sections of its strata which are superimposed like the pages of a book. Thus when the French priests arrived in the Ordos region they found, in the ravines and valleys, hundreds of natural sections awaiting their inspection.

They began their search by ascending the valley of a stream which enters the Hwang-ho from the east, just as that great river cuts the line of the wall to make its detour northwards[1] (fig. 75). They had not gone far along the ravine of this stream, known as the Choei-tong-K'eou, when Father Teilhard was surprised to

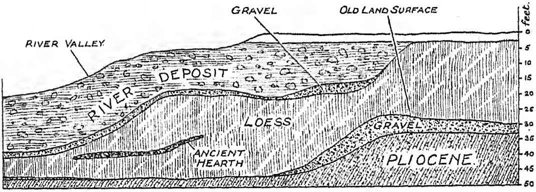


FIG. 76.—Section of the loess deposit at Choei-tong-K'eou, in which a section of a palaeolithic hearth was exposed. (Teilhard and Licent.)

observe, near the bottom of the strata exposed on the bank, "a well-marked layer of worked stones and broken bones", exactly like the hearths he had so often seen in the caves of France and Spain. The hearth, which was nearly $1\frac{1}{2}$ foot in thickness and 65 feet in extent, was buried under 40 feet of deposits, shown in section in fig. 76. Here the glacial deposits—the loess—rest on the red-earth formation of the pliocene period. Palaeolithic man had taken up his abode in this region some time after the glacial deposits began to accumulate, for his "hearth" lies some way above the bottom of the

[1] For a full account of the discoveries made by Fathers Teilhard and Licent, see *Archives de l'Institut de Paléontologie humaine, La Paléolithique de la Chine*, par M. Boule, H. Breuil, E. Licent et P. Teilhard, Memoire iv, 1928.

loess. Then, after he had forsaken the station, loess continued to accumulate until at least 40 feet were superimposed. In the loess above the hearth is a filled-up channel; after the loess was formed a stream had cut a deep bed and subsequently filled it up. Then covering all was the black crust of dusty earth over which neolithic man had tramped.

How old is the palaeolithic hearth thus discovered in waste-lands of Ordos? We may safely take the glacial deposits of Europe for guidance. Snow and ice gathered on the mountain ranges and plateaux of Central Asia at the same time as an ice-sheet formed over Northern Europe; they melted together. The loess of Ordos and of Germany are of the same date. Now the Mousterian floors of Germany lie under the loess of the last glaciation[1]; the later palaeolithic cultures appeared during its deposition. Palaeolithic man, then, was living in the Ordos area at a time when neanthropic man had just appeared in Europe bringing with him the earliest form of Aurignacian culture. In the scale of reckoning used in this work that was some 20,000 years ago.

We can understand, then, the excitement with which the two reverend fathers proceeded to explore this hearth in the depths of China. What kind of man lived in China at this remote period? How did he live? What was his culture? As to culture, they had not long to wait; implèments occurred in every part of the hearth; they collected a ton of them. They were fashioned out of quartz and represented a complex culture, one in which Mousterian, Aurignacian and Azilian elements were combined. There was, as we have seen (p. 201), a somewhat similar combination of cultures in the cave-strata of Palestine. In the Chinese culture of to-day old things are combined with new; there seems to have been the same mixture in the Chinese cultures of palaeolithic times. The men who shaped the implements and had their habitation on a site now marked by the hearth stratum were hunters; the broken bones of pleistocene animals were the remains

[1] See *Antiquity of Man*, vol. i, figs. 113, 116, pp. 315, 323.

of their feasts. The elephant they hunted was not the mammoth—but another species, *Elephas namadicus*; the horse, not the *Equus caballus* of Europe, but the Kiang of Asia (*E. hemionus*); the stag, the large deer of Ireland, gazelles and the ox provided them with food. They had with them the woolly rhinoceros, but not the reindeer. They had also the camel and the great ostrich. Bones of the wolf and of the hyaena were found in the hearth. Antlers of deer had been shaped to serve as rough tools. Clearly the Ordos region was not the arid waste it now is; in spite of glacial conditions it must have been a hunter's paradise. Although the bones of animals were plentiful in the palaeolithic camp at Choei-tong-K'eou, not a single bone was found to tell what kind of men the hunters were.

Slightly better fortune attended the exploration of a site which lies at the base of the Ordos bend, just outside the Great Wall. The Hwang-ho, as it re-enters the mountainous region of North China, is joined from the west by a tributary which arises in the southern part of the Ordos region. A branch of this tributary, the Sjara-osso-gol (fig. 75), has cut a wide channel with cliff-like sides. The section goes right through the loess deposits, which have here a depth of 210 feet (65 m.). The "yellow earth" or loess is arranged in thin horizontal strata; most of these strata are of a sandy nature and seem to have been laid down in water. Nevertheless, some of them represent old land surfaces, for between two strata, at a depth of 170 feet (55 m.) below the black surface crust, Fathers Teilhard and Licent found the site of an extensive palaeolithic camp or station. Although the site at Choei-tong-K'eou is only 150 miles to the west of it and of about the same age, yet the implements here—made of quartz—were comparatively few in number, small in size and differed somewhat in type. In the opinion of the discoverers the Sjara-osso-gol implements might be regarded as of late Mousterian or early Aurignacian workmanship. If implements were scarce, the proceeds of the hunt were particularly plentiful; the

men at Sjara-osso-gol pursued and captured the same animals as the hunters did at Choei-tong-K'eou.

When the spoil from the last site came to be examined, there were found amongst the fossil animal bones a human tooth and part of a thigh bone, the only traces left behind by the hunters of their own bodies. The fragment of thigh bone had no special characters; it had a posterior keel, a pronounced *linea aspera*, but as the exact provenance of the bone was uncertain, the discoverers prefer to leave it out of account in the meantime. Thus all that is left to tell us what kind of man the palaeolithic hunter of Central Asia was is a single tooth. The tooth is an upper incisor, the second of the left side. It was unworn—just erupted—and must have belonged to a child about seven or eight years of age.

Thus in 1924 Fathers Teilhard and Licent made the first discovery of palaeolithic man in Asia. The evidence they collected proved that men were living on the high plateau of Central Asia both before and during the last ice age, for they found crude implements on the land surface under the loess. The men of Ordos were hunters, and in shaping their stone implements they employed a technique which combined the workmanship of several of the later palaeolithic cultures of Western Europe. But as to what kind of men these hunters were—whether primitive Mongols, primitive Caucasians or perhaps members of the Neanderthal species, they had only a single incisor tooth to serve as guide. They recognized the importance of the specimen, and on their arrival in Peking took it to the Union Medical College which had been established by the Rockefeller Foundation in the capital of China. There they found a very able young anatomist—Professor Davidson Black, whom I introduce to my readers here because in the chapters which follow they are to hear much more of him. Born and bred in Canada, educated in the University of Toronto, Professor Black, before he took up his appointment in Peking, had frequented the best schools of anatomy in America and Europe and had disciplined himself for research in

all branches of his chosen subject—Anatomy. He was just the man to deal with the Ordos tooth and decipher its anatomical hieroglyphics. In fig. 77 is reproduced his drawing of the inner or lingual aspect of the Ordos incisor. It is the upper lateral tooth of the left side. After a prolonged comparison with corresponding teeth of many human races, both ancient and modern, he came to the conclusion that its markings were too equivocal in their significance to give any reliable clue to the racial nature of the Ordos hunters.[1] Yet the fact remains that this fossil tooth—one of the "shovel" pattern—shows certain features which, although not confined to people of the Mongolian stock, is yet particularly frequent in members of that stock. At least we have grounds for suspecting that the Ordos hunters will turn out to be primitive representatives of the Mongolian peoples.

FIG. 77.—Lingual aspect of the Ordos tooth—an upper lateral (left) incisor. (Professor Davidson Black.)

Amongst the teeth used for comparison by Professor Black were some from a late neolithic cave at Sha Kuo-T'un, Fengtien, in North China.[2] I mention this fact, not only because of the degree of resemblance presented by these cave teeth to the Ordos fossil, but for two other reasons. One of these is that it brings my readers in touch with the discoverer and explorer of the cave —a young Swedish geologist, Dr. J. G. Andersson, of whom we shall hear more anon. My other reason is that the condition of the human remains found by Dr. Andersson in this late neolithic cave was strangely similar to that observed by Miss Garrod in the palaeolithic cave at Shukbah, Palestine. In both caves human bones and fragments were found showing evidence that they had been deliberately broken before or soon after

[1] On a presumably pleistocene human tooth from the Sjara-osso-gol deposits. *Bull. Geolog. Soc. China*, 1927, vol. v, p. 285.

[2] "The Human Skeletal Remains from Sha-Kuo-T'un", by Professor Davidson Black, *Palaeontologia Sinica*, 1925, vol. i, fascide 3.

death; in each cave, parts belonging to about 45 individuals were found, but in the greater number of cases the body of an individual was represented by only one or two bones or fragments of bones; in both caves there were some intact burials, but the majority of the bones were scattered indiscriminately in the deposits of the floor. Both Dr. Andersson and Miss Garrod inferred that their cave-dwellers had been cannibals; such a supposition affords the most likely explanation of the conditions found. It is a remarkable fact that in two communities, separated so widely in time and in space, we should find strange and unsavoury practices so similar in their manifestations.

Before proceeding to give an account of the discovery which is to be dealt with in the chapter which follows, a discovery which is one of the most significant ever recorded in the annals of prehistory, there is one other addition to our knowledge of palaeolithic man in Mongolia which deserves mention here. At the time Fathers Teilhard and Licent were searching the glacial strata of the Ordos region of China, on the southern margin of the Gobi desert, Dr. Roy Chapman Andrews was leading the 3rd Asiatic Expedition of the American Museum of Natural History of New York across the desert towards the Altai mountains on its northern side. As all the world knows, eggs of the Deinosaur were found. Under the sands of the dunes, at the foot of the eastern slopes of the Altai and not far from the haunts of the ancient Deinosaurs, a site was discovered on which palaeolithic hunters had lived. They made necklaces by piercing fragments of the Deinosaur eggs; they used chips from ostrich eggs for the same purpose. Their implements were fashioned out of chert, jasper and chalcedony, but represented a much later type of workmanship than that of the Ordos hunters. In culture these northern hunters had reached the stage practised by the Azilians of Europe. Of the hunters themselves not a bone was found. From these few preliminary discoveries we are justified in believing that evidence for

the reconstitution of the history of man in Asia is discoverable, and so far as the few facts at our disposal will permit us to judge, we may expect to find in Asia a succession of breeds of men and kinds of culture which will present many points of resemblance to the men and the cultures of palaeolithic Europe.

CHAPTER XVII

THE DISCOVERY OF SINANTHROPUS

THE archaeological discoveries described in the preceding chapter are of importance because they mark a beginning in the opening up of the vast unexplored prehistoric territories of Central Asia. Nevertheless, they rank only among the everyday happenings of modern archaeology; they relate to a past time when man was already full-blown in body and in brain. The discovery we are now to describe belongs to another order of events. It is of the first magnitude and takes its place with four others—the finding of the fossil bones of Pithecanthropus in Java by Dr. Eugene Dubois (1891–94); the discovery of the Piltdown skull in Sussex by Mr. Charles Dawson (1911–13); the unearthing of the Heidelberg jaw in the sandpit at Mauer (1907); and the discovery of the fossil bones of Rhodesian man in the mine at Broken Hill (1921). Each of these four discoveries added a new chapter to our knowledge of man's remote past, each was so fraught with strange facts that anthropologists were compelled to re-orientate their conception of the mode, time and place of human evolution. The discovery made at Chou Kou Tien near Peking reveals to the world another of its ancient types of humanity—the Peking type. In one sense the discovery so recently announced is the most important of all. After a critical examination of all the facts relating to the Peking type, which have been so ably laid before his colleagues by Professor Davidson Black,[1] I have come to the con-

[1] The following are the chief publications relating to Sinanthropus:

Professor Davidson Black, "Lower molar hominid tooth from Chou-Kou-Tien deposit", *Palaeontologia Sinica*, 1927, vol. ii, p. 1; "Preliminary note on additional Sinanthropus material discovered in Chou-Kou-Tien during 1828", *Bull. Soc. Geol. China*, 1929, vol. viii, p. 16.

Dr. J. G. Andersson, "Essays on the Cenozoic of Northern China", *Mem. Geol. Survey China*, 1923, Series A, No. 3, pp. 1–152.

Dr. Otto Zdansky, "Ueber ein Säugerknochenlager in Chou-Kou-Tien", *Bull. Geol. Survey China*, 1923, vol. i, No. 5, p. 83; "Preliminary notice on

clusion that an early pleistocene ancestor of the modern type of man—neanthropic man—has at last come to light.[1] The antiquity of the fossil remains and their Asiatic position have a most important bearing on the evolution of all living races of mankind. The date is early pleistocene, giving the remains an antiquity of a quarter of a million years on our scale of reckoning. The being represented was therefore contemporary with the Piltdown type—perhaps not so old as the type of Java, but earlier than the Heidelberg and much older than the Rhodesian. The homeland of this ancient type—in the Far East—is also significant. In these later years we have speculated much as to the region of the earth in which the neanthropic type of manhood had come into existence, but for lack of data have made little progress towards a solution. This discovery points definitely to Asia. I have outlined the reasons which lead me to attach a high value to the Peking discovery in order that readers may have patience with me when I enter somewhat fully into structural peculiarities of this very ancient representation of modern humanity.

The reader has been introduced already to Dr. J. G. Andersson, a Swedish geologist attached to the Geological Survey of China. In 1920 business led him into the hilly region which lies to the south-west of Peking, and there at a distance of only 37 miles from the capital he found himself in a limestone formation—a hilly country—which aroused his interest, particularly certain deposits in vast and ancient caves and fissures at Chou Kou Tien. These deposits had been infiltrated

two teeth from a cave in China", *Bull. Geol. Survey China,* 1927, vol. v, p. 279.

Dr. A. W. Grabau, "Summary of the Cenozoic and Psychozoic deposits with special reference to Asia", *Bull. Geol. Survey China,* 1927, vol. vi, p. 151.

[1] This chapter (XVII) was written before the Peking skull had been discovered and when we had only fragments of jaws and a few stray teeth to guide us to the nature of Sinanthropus. The discovery of the skull, as related in Chapter XVIII, revealed unexpected traits. I have thought it best to leave this chapter just as it was written in order that readers may see for themselves how far the methods of anatomists are fallible.

long ago by lime-laden drip from the cave roof and had assumed the consistency of hard rock. The rock he found was fossiliferous, but the extraction of its contents offered great difficulties. It had to be blasted and quarried before its contained fossils could be exposed, and even then infinite care and labour were needed for their complete extraction. The bones were chiefly those of large mammals, many being of species no longer living in China. Indeed, during his earlier investigations Dr. Andersson formed the opinion that the contained species represented the fauna of China in late pliocene times, but further investigation—particularly the fact that a true horse had replaced the three-toed horse or hipparion—led him to assign the formation of the Chou Kou Tien deposits to an early point of the pleistocene. It is satisfactory to know that this opinion was formulated and confirmed long before there was any suspicion that man himself was a member of the cave fauna. It has so often happened in the past that the discovery of human remains in a deposit has influenced expert opinion as to its age; the tendency has always been to interpret geological evidence so that it would not clash flagrantly with the theory of man's recent origin. The early pleistocene age of Peking man was fixed before he was discovered.

Dr. Andersson, having duties which called him elsewhere, entrusted the excavation of the Chou Kou Tien deposits to a young German geologist, Dr. Otto Zdansky. By 1926 a very large assemblage of fossil bones had been accumulated, and as there were no means of making exact identifications in China, Dr. Zdansky carried the collection to the laboratory of Professor Wiman in the University of Upsala, Sweden, and there devoted himself to a minute examination of the fossils collected in the cave deposits of Chou Kou Tien. In the course of his examination, during the summer of 1926, mingled with other fossil fragments, he came across two human teeth. They were in the same state of mineralization as the fossil mammalian teeth. One was the unworn crown of a lower premolar tooth, human in all its features.

The other, a worn upper third molar (wisdom) tooth, although clearly human, yet had certain uncommon characters. The discovery of human teeth was not altogether unexpected.[1] Dr. Andersson had observed while the cave deposits were being dug, roughly shaped pieces of quartz amongst the blocks; they were foreign to the locality and their presence could only be explained by supposing that they had been brought into the cave by man.

When news of Dr. Zdansky's discovery reached Peking, the authorities there resolved to push forward the exploration of the cave deposits at Chou Kou Tien with vigour. The Director of the Geological Survey, Messrs. Ting and Wong, in spite of the unsettled state of government and of military operations which threatened Peking, entered into these plans with alacrity, and in the spring of 1927 sent out a company of workers in charge of Mr. C. Li. The Union Medical College, under the enthusiastic leadership of Professor Davidson Black, obtained financial support for the project from the Rockefeller Foundation. Dr. Birger Bohlin, a young Swedish geologist, joined the excavating party and took charge of the more scientific aspects of the search. The company of cave explorers took the field in the spring of 1927 and laboured until October with no success so far as the search for traces of man were concerned, but on October 16th, three days before wintry weather made further work impossible, an important find was made. A human tooth became exposed on the working surface of the cave deposits. Dr. Bohlin succeeded in removing it, still surrounded by its strong matrix, and straight away carried his precious find to Peking—a journey of 37 miles made in a jinrikisha and through a country infested by soldier bandits. Arriving safely in the capital, he handed it over to Professor Davidson Black. On being

[1] When Professor Max Schlosser published a monograph on fossil bones from China in 1903 (*Di Fossilen Saugethiere Chinas*), he described a fossil molar tooth, but its characters left him uncertain as to whether it should be ascribed to a man or an ape. This tooth had been purchased in a native drug store in Peking where fossil remains were ground down for medicinal purposes. Most probably it came from the Chou Kou Tien deposit.

freed from its matrix, the anatomist perceived that it was clearly human and one of the lower molar series. Fortunately it was an unworn tooth and thus retained all its markings in a clearly decipherable state. From a consideration of these Professor Black inferred that the tooth could not be attributed to any known race or species of mankind, living or extinct. So much did it differ from other molar teeth in its essential characters that he concluded the kind of man who lived so long ago in the Chou Kou Tien caves must be as distinctive in his characterization as were *Pithecanthropus erectus* and

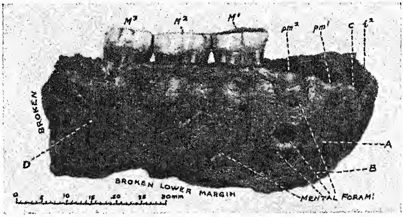


FIG. 78.—Right ramus of mandible of Sinanthropus. The empty sockets of the two premolars, canine and lateral incisor (i^2) are indicated. A, subcanine fossa; B, mental ridge; D, masseteric impression. (Reproduced by permission of Peking Union Medical College.)

Eoanthropus dawsoni. He therefore, on the evidence of this one tooth, created a new genus of humanity, which he named *Sinanthropus*, the "Man of China"; the particular species represented by the tooth becoming *Sinanthropus pekinensis*. To those unfamiliar with the hieroglyphs of teeth such a precipitate act of christening—on the evidence of a single tooth—may appear audacious; Professor Black took the step knowing full well that further search in the cave might prove he had made an egregious blunder. We shall see that his audacity was justified; renewed exploration of the cave brought proofs of the soundness of his inferences.

In the summer of 1928, although disorder still pre-

vailed round Peking, the cave party returned to work and toiled without success until November, when just as winter set in it struck two veins rich in sinanthropic remains. One was at the old site (see fig. 89, A), the one which yielded the critical lower molar and had given Dr. Zdansky a lower premolar and upper third molar. Here was found the greater part of the right half of a lower jaw of an adult (fig. 78); also four additional teeth—an upper central incisor (imperfect), an upper molar, two lower incisors (one of which was broken). From the new site (fig. 89, B), adjacent to the old and

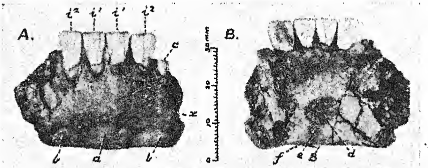


FIG. 79.—A. The anterior aspect of the chin region of the lower jaw of a sinanthropic child. a, mental tubercle (rudiment of true chin); b, mental ridge; x, subcanine fossa; i^1, i^2, permanent incisors; c, broken root of milk canine. B. The hinder (lingual) aspect of the same specimen. d, genial fossa with impression for the attachment of the chief muscle of the tongue—the genioglossus; e, impression for genio-hyoid muscle; f, impression for digastric muscle on lower border of simian shelf; g, median tubercle of shelf. (By permission of the Peking Union Medical College.)

although at a higher level, of the same age, came most important additions. The most significant were large fragments of vaults of skulls which were embedded in the hard travertine rock, and were crushed and flattened by pressure of the superimposed deposits. The dimensions of these cranial fragments are such as to assure us that in size of brain Sinanthropus had attained a human status. Peking man, Professor Black concluded, "was a large-brained form". From the new site (B) was obtained, besides about a score of isolated teeth, two parts of the lower jaw of a child, which had been about seven or eight years of age at the time of death. One part includes

the region of the chin and carries the freshly erupted lower incisor teeth; this fragment is reproduced in fig. 79. It shows an early stage in the evolution of the human chin. We see, too, on its hinder aspect, as in the Piltdown mandible, certain simian traits, including the digastric shelf (simian plate) and genial pit or fossa.

Thus we have at our disposal parts of several individuals, both old and young, to guide us to the nature of the people who lived in China some quarter of a million years ago. The fragment of the adult lower jaw (fig. 78) is sufficiently complete to permit us to make a comparison between Sinanthropus and other ancient types of man—such as the Piltdown and Heidelberg. The three molar teeth moderately worn in the crowns have a combined length of 34 mm.; measured from a photograph the length of the first molar is 11·6 mm., the second 11·4 mm.; the third 11 mm. The total molar length and the proportion contributed by each tooth are such as we expect to meet with in the jaws of aboriginal (male) Australians. The total molar length in the Heidelberg mandible is 36·5 mm.; in the Piltdown mandible it was still greater—38 mm. Thus in molar development Sinanthropus falls short of the two most ancient types of Europe and approaches a modern development. The premolar teeth have fallen from their sockets, but the space they occupied can be measured; it was not more than 14 mm., also a moderate amount met with in the jaws of living races. We know from the evidence of isolated specimens that in their cusp development the premolar teeth of Sinanthropus were altogether human. Nor can there be any doubt about the canine tooth; the empty socket is of ordinary dimensions; in canine development Sinanthropus agrees with the ancient type of Heidelberg and of Java, and differs from Piltdown man, in whom the canine was long and pointed. The Sinanthropic mandibular fragment is broken short at the socket for the second incisor, but we know from the child's jaw (fig. 79) that the permanent lower incisors were not large in their dimensions. The crown of the

lateral incisor of the child's jaw is 6·8 mm. wide; the width of the central 6·5 mm. We are therefore in a position to effect a reconstruction of the lower dental arcade of the adult Sinanthropus, such as is shown in fig. 80, where the missing incisor part has been made good and the missing left half of the jaw filled in by duplicating the right half. As so reconstructed the dental arcade has a length of 57 mm., measured from the anterior margin of the incisor sockets to a line adjoining the hinder borders of the last molars. We know from

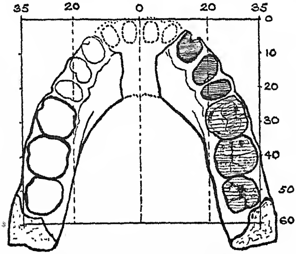


FIG. 80.—The lower dental arcade of Sinanthropus. The left half has been reconstructed by duplication of the right half, of which all but the incisor region was found. Further explanation in the text.

the child's jaw that the lower incisors were not vertical as in most modern races, but were inclined forwards, so that 3 mm. may be added on account of the slope of the incisor crowns, making a total length of 60 mm. This, although 10 mm. more than in modern European males, is 2 mm. less than in a Tasmanian whose skeleton is preserved in the Museum of the Royal College of Surgeons, England, and is just equal to the Heidelberg length, but 10 mm. short of the lowest estimate for the Piltdown mandible. As reconstructed in fig. 80, the width of the dental arcade, measured between the outer borders of the second pair of molars, amounts to 68 mm., the same as in the Heidelberg jaw, but 4 mm. less than

the estimate for the Piltdown mandible. The area of the lower dental arcade in this sinanthropic man must have been about 32 cm.², 3 cm.² less than in the Heidelberg jaw, 8 cm.² less than in Piltdown, but 7 cm.² more than in the average modern Chinaman. Thus we find that in dental development Sinanthropus approaches nearer to the modern state than was the case in all known representatives of early pleistocene man. The dimensions of its teeth and their arrangement in the jaw fall within the range of variation met with in the more primitive of living races.

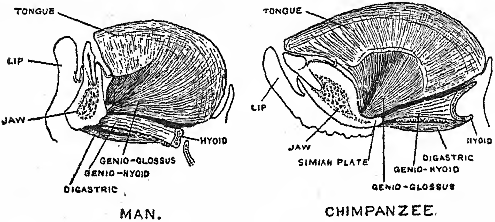


FIG. 81.—Sections of the lower jaw of a modern man and of a chimpanzee, to show the human and simian modes of attachment of the muscles of the tongue to the hinder aspect of the chin or symphyseal region.

When we turn to the study of the bony framework, on which the teeth were set, we find features in Sinanthropus which have never been seen in any human race, ancient or modern, and yet they are just such as we should expect in an ancestral stage in the evolution of neanthropic man. In order that the reader may appreciate the evolutionary significance of the features manifested in the chin region of the lower jaw of Sinanthropus, I reproduce two sections in fig. 81. One is a vertical section of the chin or symphyseal region of a modern European; the other, of the same part of the jaw of a chimpanzee. In the ape (chimpanzee) there is no prominence or chin; the anterior face of the jaw slopes

downwards and backwards to end in the simian plate. The chief muscle of the tongue—the genio-glossus—arises from a deep pit on the hinder aspect, just where the alveolar bone—which carries the roots of the incisor teeth—merges into the simian plate. To the hinder margin of the simian plate are attached two muscles, the hyo-glossus and digastric (fig. 81). The section of the human symphyseal (chin) region appears to differ profoundly from that of the chimpanzee (fig. 81); we

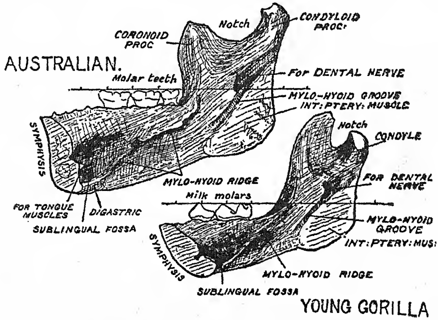


Fig. 82.—The right half of the lower jaw of an Australian aborigine and of a young gorilla. In each the symphyseal region is exposed in vertical section to show correspondence of parts.

observe that the bone at the lower end of the section in place of being turned backwards to form a simian plate has grown forwards as a mental eminence or chin, and in the process of transformation has carried along with it the muscular attachments of the genio-glossus, genio-hyoid and digastric. The human symphyseal region is so different from that of the ape that at first sight it seems impossible to conceive how the simian plate of the ape could be transformed into the mental eminence of man. The jaw of Sinanthropus supplies one of the missing evolutionary stages.

In fig. 82 are reproduced corresponding sections of the chin region of the lower jaw of an Australian aborigine and of a young gorilla to illustrate stages in the transformation of the chin from the simian to the human form. On the hinder aspect of each a pit is to be seen; all below the pit represents the simian plate. In the infant gorilla the pit is small and the plate short and thick; as the ape grows up the pit expands into a fossa and the plate becomes attenuated and extended in a backward direction. In the Australian's jaw the pit has become almost filled by the outgrowth from the floor of a tubercle or spine of bone from which the chief muscle of the tongue—genio-glossus—takes its origin. The bone of the simian plate, as seen in the section, has much the same shape as in the jaw of the young gorilla.[1]

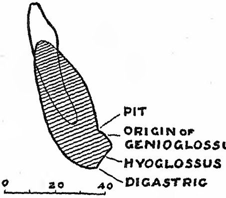


Fig. 83.—A vertical section of the symphyseal region of the lower jaw of a sinanthropic child. (After Professor Davidson Black.)

Professor Black has made an exact tracing of the chin region of the lower jaw of the sinanthropic child; it is reproduced in fig. 83. It has the same conformation as in the young gorilla; there is the same genial pit on the posterior aspect of both. This pit marks the junction of two parts of the jaw which are different in structure and function. The upper or alveolar part is concerned in the support of the incisor teeth. The lower, basal or plate element, is for giving attachment to muscles; the lower or muscular element is part of the basal framework of the mandible. Both elements are to be recognized in the symphyseal region of the gorilla and in Sinanthropus, and they have a similar form in section in both beings. Yet when we examine the anterior aspect of the chin region of the sinanthropic child (fig. 79), we see what never appears on an ape's jaw—a growth or eleva-

[1] See also *Antiquity of Man*, vol. ii, p. 637.

tion of bone on the front aspect of the basal part of the symphysis, the beginning of a true chin (fig. 79, A). We also observe that this elevation is being joined on each side by a strengthening or outgrowth of the basal bar of the neighbouring parts of the mandible. In brief, we have in Sinanthropus a very early stage in the evolution of that hall-mark of humanity—the chin.

An examination of the lateral aspect of the lower jaw of the adult Sinanthropus (fig. 78, p. 258) also reveals evidence of a transitional stage 'twixt ape and man. As is usual in great anthropoid apes, there are several openings or mental foramina by which branches of the dental nerve escape to supply the skin of the chin. In Sinanthropus there are four such openings (fig. 78), whereas in modern races there is usually only one. We see, too, an early stage in the separation of the two elements which make up the body of the lower jaw—the alveolar element which provides sockets for the teeth and is subservient to dental needs, and the basal element—the framework of dense bone on which the alveolar element is supported. In anthropoid apes the alveolar bone overshadows the basal element; in modern man it is the opposite; the alveolar bone is reduced and the basal bar becomes differentiated and prominent. In Sinanthropus we see an intermediate stage. Although the basal bar which extends from the attachments of the masseteric impression to the chin has been broken away, the anterior part still remains (fig. 78, B). It is separated from the alveolar element by a depression or groove, the subcanine fossa (fig. 78, A). No doubt the basal bar, as it proceeded forwards, joined the mental eminence and made its contribution to the formation of a rudimentary chin. Never before has a human jaw been seen with the sockets of the teeth so prominently marked outwardly as in the mandible of Sinanthropus. In spite of the crude formation of the mandibular features of Sinanthropus, they are just those we expect to find in a simian jaw shaping towards a modern human form.

With the greater part of the right half of a lower

jaw at our disposal it is possible to reconstruct the lower part of the facial profile of Sinanthropus. Let us compare his mandibular profile with that of Heidelberg man—the strongest jawed of early human types. The jaws are so superimposed that the first molar tooth of the one falls on the corresponding tooth of the other. When this is done it is seen that, although the Heidelberg molars are larger, the teeth of the one agree in place and order with the teeth of the other; the retreating lines of their

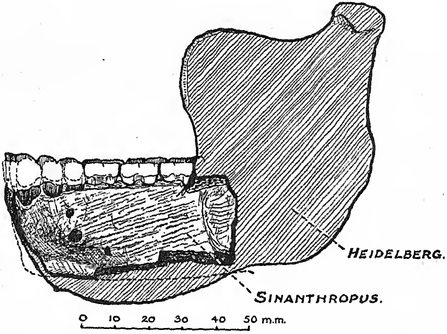


FIG. 84.—The mandible of Sinanthropus, represented in true profile and superimposed on a similar representation of the Heidelberg mandible.

chin regions are also similar, save that in Sinanthropus, had the specimen been complete, we should have found a mental eminence which is quite lacking in the Heidelberg mandible. The real difference between these two ancient mandibles lies in the depth of their horizontal rami or bodies; in the premolar region the depth of the jaw in Sinanthropus is 26 mm., in the Heidelberg jaw 33 mm., in the Piltdown 32 mm. and in a jaw of an Australian aborigine 32 mm. The body of the mandible of Sinanthropus was remarkably shallow, and in this feature it resembled the jaw of the chimpanzee. On the

other hand, it was remarkably thick and strong, its thickness at the second molar measuring 16 mm. Skiagrams of the sinanthropic mandible reveal a dental canal with clearly marked walls and of such large dimensions as have never before been seen in a human jaw. Altogether the bony framework of the mandible of Sinanthropus reveals a strange mixture of traits—partly human, partly anthropoid.

In the structure of its jaw Sinanthropus combines human and anthropoid characters. In the teeth we again meet with a similar combination, only here we meet

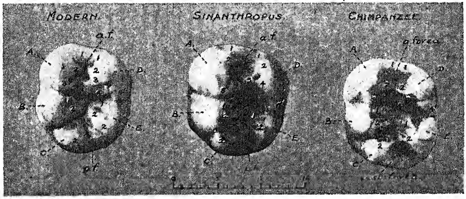


Fig. 85.—Reproduction of a photograph of the upper aspect of the first lower left molar of Sinanthropus set between the corresponding teeth of a Chinese child (modern) and of a young chimpanzee. The three outer cusps are lettered A, B, C, from before backwards; the two inner D, E, in the same order. (After Professor Davidson Black.) Further explanations are given in the text.

with traits which link Sinanthropus not to other extinct types such as Piltdown, Heidelberg, Neanderthal, but to races of the modern or neanthropic type. Let us look at these modern traits. In fig. 85 I reproduce a photograph from Professor Black's first monograph, published in 1927[1]; the photograph shows, in the middle figure, the crown of the molar of Sinanthropus[2]—that of a child about seven years of age; it is a lower molar, the first of the left side; it is almost unworn, so that all details of its cusp formation are revealed. To simplify my

[1] For references, see p. 254.
[2] It was from this tooth that Professor Davidson Black inferred the existence of Sinanthropus.

description I have lettered the five cusps A, B, C, D, E. A, B, C being the three outer cusps from front to back, D, E the inner cusps in the same order. On one side is set the corresponding tooth of a Chinese child, on the other is that of a young chimpanzee. In each the same five cusps are present and have been given the same letters.

The crown of a tooth differs in its development from all other structures of the body; like a house its foundations are laid down full-sized at the very beginning. When a molar crown is being formed in a child's jaw, five separate points appear; these are the apices of the cusps; they are set at the right distances apart. Then the bases of the cusps, when they begin to form, extend towards each other until they meet and fuse and thus form the chewing surface of the crown; we can see the lines of their junction in fully formed teeth (fig. 85). Now in the molar crown of the chimpanzee—which copies a very old simian pattern[1]—the two anterior cusps A, D, throw out towards each other certain ridges. Cusp A throws out three ridges which are numbered 1, 2, 3 in fig. 85; D throws out four, numbered 1, 2, 3, 4. The ridges numbered 2, 2, meet and form a prominent, cutting transverse ridge in the chimpanzee molar. The development of this ridge cuts off the front part of the original cup of the crown; it is known as the anterior fovea (fig. 85). Now the ridge (2, 2) and the fovea are constituents of the anthropoid molar; they are preserved in all their pristine form in the Neanderthal tooth from Shukbah (fig. 62, p. 206). We see that they are represented in the molar of the Chinese child (fig. 85), but the processes 2, 2, have failed to join and the anterior fovea extends into a part of the original cup. In modern races the anterior fovea and the ridge behind it are in

[1] Those who wish further information concerning dental patterns should consult Dr. W. K. Gregory's monograph on *The Evolution of the Human Teeth*, 1922; "The Dentition of Dryopithecus and the Origin of Man", *Anthropological Papers of the American Museum of Nat. Hist.*, 1926, vol. 28, part i; and Dr. Adolf Remane's monograph, "Beiträge zur Morphologie des Anthropoidgebisses", *Archiv für Naturgeschichte*, 1921, heft xi.

a state of retrogression. We did not expect retrogression of these elements in the molar teeth of ancient man and are therefore surprised to find that this process of reduction had proceeded further in Sinanthropus than in modern races. In the sinanthropic molar the ridge 2, 2, has almost failed to form (fig. 85) and merely a vestige of the anterior fovea is present. On the other hand, certain elements of the cusps A, D, which take a minor part in the chimpanzee's molar, come into prominence in the modern molar and also in that of Sinanthropus. These elements of cusps A, D, are numbered 3, 4, in fig. 85. In cusp A of the chimpanzee 3 is represented by two folds applied to the posterior aspect of the main ridge 2, 2; in the Chinese molar these folds are isolated and large and run into the crown to meet a ridge (3) from the inner cusp D; we see the same processes rising to prominence in the molar of Sinanthropus, but they show a more reduced development then even in the Chinese child. In the chimpanzee molar the hinder part of the inner cusp (D) is separated from the rest by a fissure—the part numbered 4′ in fig. 85. From this accessory part a fold passed into the cup of the crown; the fold is applied to the hinder aspect of the main ridge (2, 2). In the Chinese molar this element 3, 4, has become large; it meets and fuses with corresponding folds from the outer cusp A. An examination of the photograph of the crown of Sinanthropus will show that these elements 3, 4, of the outer and inner cusps (A, D) have undergone a change of the same kind as in the molars of modern man, but the degree of reduction or retrogression is greater.

I do not propose to enter into the conformation ot the three posterior cusps (B, C, E) in great detail. The two hinder cusps (C, E) of the chimpanzee molar (fig. 85) are united by a ridge and thus the hinder part of the original cup of the crown is isolated to form the posterior fovea. In Sinanthropus both ridge and fovea, although reduced, are yet clearly apparent, whereas in the modern molar degeneration has proceeded much

farther; ridge and fovea are represented by mere vestiges (fig. 85). It is strange that in the molar teeth of Neanderthal man—particularly in the Shukbah specimen (fig. 62, p. 206)—that while the anterior ridge and fovea retains a pristine chimpanzee-like development, the hinder ridge and fovea should have been reduced to an even greater extent than in the molars of modern man. Thus while we see that all five original cusps are retained on the typical molar of Sinanthropus, yet we find several primitive features have been lost—the anterior ridge and fovea, and certain new features have appeared—in all of which changes the state of parts in molars of neanthropic man are recalled, yet in its hinder moiety primitive features are retained. This retention may be due to a relationship between the anterior and posterior moiety of the molar of Sinanthropus to which Professor Black has drawn attention. The anterior moiety is slightly wider than the posterior, as is the case in the molars of anthropoid apes and of Piltdown man. In modern and Neanderthal molars the reverse is the case; the posterior moiety is the wider.[1]

[1] *Measurements of Sinanthropus First Molar.*—All of these, with the exception of the Neanderthal tooth from Shukbah, are taken from Professor Davidson Black's monograph (reference on p. 254).

	A.	B.	C.	D.	E.	F.	G.
Sinanthropus (child) ...	12·3	11·0	17·3	5·1	12·2	9·9	9·9
Sinanthropus (adult) ...	12·0	12·0	18·0	5·6	12·4	8·6	—
Shukbah	13·5	12	20·7	6·2	14·5	12·5	10·2
Piltdown	12·5	11·0	18·0	6·0	12·0	8·5	—
Heidelberg	11·6	11·2	—	—	—	—	—
Chimpanzee	12·0	10·5	16·5	6·0	10·5	7·7	8·6
Chinese child	11·0	10·5	19·5	7.7	11·8	8·9	8·5
Australian (Campbell)	12·3	11·9	—	—	—	—	—

A. Length of crown.
B. Width of crown.
C. Total length of tooth measured from point of anterior external cusp to tip of anterior root.
D. Height of crown measured on anterior cusp to lower margin of enamel.
E. Length of anterior root.
F. Height of body measured from the level at which roots bifurcate.
G. Maximum width of anterior root.

When the outer aspect of the molar of Sinanthropus is compared with the same aspects of the corresponding tooth of a child and of a chimpanzee, as has been done by Professor Black (fig. 86), certain intermediate characters again become apparent. The margin of the crown of the chimpanzee molar projects well beyond the line of the neck of the tooth; the margin of the crown is rounded or markedly convex as viewed in profile. The cusps, if we may compare them to the petals of a flower, are folded inwards as in the bud of a buttercup. The

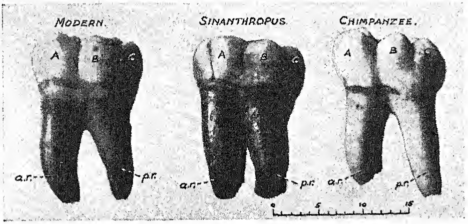


FIG. 86.—The outer or labial aspect of the first molar of Sinanthropus compared with the same aspect of the first molar of a Chinese child and of a young chimpanzee (Professor Davidson Black). A, B, C, outer cusps named from before backwards; a.r., anterior root; p.r., posterior root.

cusps on the crown of the child's tooth are more upright; they stand up like the petals of a tulip; the sides of the crown therefore project less beyond the neck and are flatter or less convex than in the chimpanzee. In all these points and also in the degree to which the cusps are separated, the molar tooth of Sinanthropus takes up a position between the simian and human forms; in these points Sinanthropus resembled Piltdown man. A primitive molar, such as that of the chimpanzee, has not a high crown. On the other hand, the crowns—as may be learned from the table on p. 270—are high in the molar teeth of modern man and also Neanderthal man. Sinanthropus had low-crowned molars, in this

resembling the chimpanzee. When, however, we compare the roots of the three teeth shown in fig. 86, we see that in their conformation those of the modern child are more anthropoid than those of Sinanthropus. The molar roots in this early fossil type are remarkably straight, strong and stumpy. We notice, too, that the roots of the chimpanzee's molar separate a short distance below the crown, whereas in Sinanthropus the separation is at a lower level than in the molar of the modern child. The height of the body of the molar tooth (see table on p. 270, column F) is 7·7 mm. in the chimpanzee, 8·9 mm. in the modern child, 9·9 in Sinanthropus, 12·5 in the Shukbah molar, while in some specimens of Neanderthal molars the body may be so deep that it extends to the root tips (see *Antiquity of Man*, vol. ii, p. 685, fig. 249).

The feature we have just discussed, the expansion of the body of the molar tooth, brings us to a rather unexpected feature in the teeth of Sinanthropus—the enlargement of their pulp cavities. In most characters the molar teeth of this ancient type are altogether unlike those of Neanderthal man; their resemblances are towards the anthropoid in some points and towards modern human in others. But in the enlargement of the pulp cavities of the molar teeth Sinanthropus departs from the ape and from modern man and approaches Neanderthal man. In fig. 87 I reproduce Professor Black's diagram in which a tracing of an X-ray of the sinanthropic molar is set between two others, one of the molar of a modern child (Chinese) and the other of a molar of a chimpanzee. In the latter the pulp cavity is wide and low; in the modern molar it has expanded downwards into the upper region of the roots; in Sinanthropus the invasion of the root region is extensive; a moderate degree of the condition known as Taurodontism is present.[1] The degree is about the same as in the molars of that early representative of the Neanderthal type—Heidelberg man. There is some degree of Taurodontism in the Piltdown molars.

[1] See *Antiquity of Man*, vol. ii, p. 684.

Professor Black is inclined to regard Taurodontism as a character of primitive humanity. I cannot share that view; it is a mark of dental degeneration. Modern man is not taurodont; like the ape, he is cynodont. I cannot believe, if modern man came of a taurodont ancestry, that his molar teeth could have reverted to a cynodont form—which is the opposite of taurodont. It is for this reason that I hesitate to place Sinanthropus on the direct line which leads to modern man, but if not actually in the line of direct descent he stands nearer to that line than any human fossil type discovered so far.

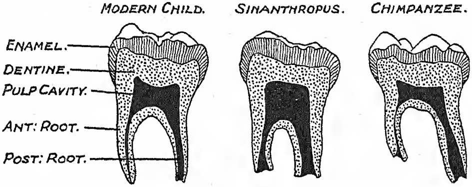


FIG. 87.—Tracing of a skiagram of the Sinanthropus molars to show the enlargement of their pulp cavity. Similar tracings of the first molar tooth of a chimpanzee and of a Chinese child are reproduced for comparison. (Professor Davidson Black.)

In concluding this chapter I will attempt to sum up the gains to our knowledge of ancient man which have accrued from the discoveries made in this cave, situated among the hills to the south-west of Peking, gains which we owe to the united enterprise of the Geological Survey of China and to the Peking Union Medical College. Until this discovery was made, we had obtained only three glimpses of early pleistocene man in widely separated parts of the earth—in Java (*Pithecanthropus*), in England (*Eoanthropus*) and in Germany (*Palaeoanthropus*). Pithecanthropus we may exclude from the direct ancestry of modern man; when we find that there were big-brained human forms early in the pleistocene period we must regard the small-brained Pithecanthropus as a

survival from some earlier phase of evolution. Piltdown man, save for the simian features of his tooth and jaw, probably does represent the stage of evolution reached by the ancestry of modern races early in the pleistocene. Of Palaeoanthropus we know only the lower jaw and teeth, but with such teeth we may safely prognosticate a brain which was already human in size. Such was the state of our knowledge until 1927, when Sinanthropus made its appearance at the opposite end of the old world to that which had given us the Piltdown and Heidelberg types. From this discovery we learn that in early pleistocene times a strange form of humanity existed in the Far East —already human in size of brain[1] but showing a strange mixture of characters, both old and new, in jaw and tooth. He differed from his contemporary, Piltdown man, far more than the negro now does from the Chinaman. He differed just as much from the man of Heidelberg, who probably belongs to a somewhat later date. Sinanthropus possessed characters which give him better claims than his contemporaries to be regarded as on, or nearly on, the evolutionary line which leads to modern races of mankind. If my inference is just, then the discovery is of the highest significance, for we would then be on the track of our ancestors. This discovery in China also serves to prove the extraordinary diversity of the races, species, genera of mankind which peopled the world in early pleistocene times. To realize the condition of the world's population, then, we have to think of the state of the anthropoid world to-day where we find genera such as the gorilla, chimpanzee and orang occupying small and isolated areas of the world. Only the genera of mankind at the beginning of the pleistocene period was not three in number; more probably there were thirty or more utterly diverse types. As yet we know of only three of these early genera.

[1] See the following Chapter (XVIII).

CHAPTER XVIII

SINANTHROPUS—PEKING MAN

THE previous chapter was written during the month of September 1929. At that time the working party at Chou Kou Tien, under the direction of Mr. W. C. Pei, had reached a very great depth in its fossiliferous deposits; the stratum which they were then excavating lay over 110 feet below the original roof of the cave or fissure (fig. 89). A few more human teeth had been found, but it looked, even towards the end of November, when winter set in with more than usual severity, that the third season's work (1929) was to come to an end leaving the problem of Sinanthropus still unsolved. Just then, however, the deposits were found to extend into a side or accessory cave. Before finally closing down, Mr. Pei determined to "remove the uppermost part of the accumulation filling the cave. At four o'clock next afternoon (December 2, 1929) I encountered the almost complete skull of Sinanthropus. The specimen was embedded in loose sand, and partly in a hard matrix, so that it was possible to extricate it with relative ease".[1]

The news of this important find soon reached Europe, and those who had followed the discoveries already announced by Professor Davidson Black, were on the *qui vive* as to what sort of man Sinanthropus would prove to be. Readers who have followed my summing up of the evidence, given in the previous chapter, will have seen that I expected a human type which would serve as a common ancestor for races of the modern or neanthropic type. My anticipation was founded on the characters of the teeth and jaws; they seemed to herald the existence of a neanthropic type. There was, to be sure, the incipient taurodontism of the molar teeth which roused a suspicion of Neanderthal affinities, but the cusp pattern differed so markedly from that of Neanderthal

[1] W. C. Pei, "The Discovery of an adult Sinanthropus Skull", *Bull. Geolog. Soc. China*, 1929, vol. 8, p. 203.

man that I attached but little importance to this suggestion. Professor Davidson Black soon set our minds at rest. The block containing the skull was carried to his laboratory in the Union Medical College, Peking; he at once set to work, freeing the skull from the hard stony matrix which enshrouded it, and by the summer of 1930 had exposed the essential cranial features of Sinanthropus —Peking man. Only the brain-containing part of the skull had been preserved in the cave; the facial parts and some bones of the base were missing. To prepare a full report of such a strange type of skull and to discern all the impressions left within it by the brain must entail many months of investigation, so that we cannot expect Professor Davidson Black's full account for some time to come. In order, however, that his fellow anatomists may share his secrets he has, with a generosity which is exemplary, placed at their disposal life-size photographs of all aspects of the skull, with a preliminary account of its characters and measurements. The statements made here and the illustrations reproduced are founded on documents which Professor Davidson Black has placed at my disposal.[1]

What kind of man, then, did Sinanthropus prove to be? Professor Davidson Black named him when only a single molar tooth was known; he wisely never hazarded a guess as to what form the completed man might prove to take. I, less wisely, was more daring. As the reader will have learned from the last chapter, I expected a primitive type of modern man—a crude form of Australian aborigine. Peking man proved to be, as we shall seek to show presently, an amazingly low type, unexpectedly like the Java man in form of skull and size of brain. Sinanthropus, however, is distinctly higher in the scale of evolving humanity than is Pithecanthropus; his brain is somewhat bigger; no doubt, in his brain cast we shall find evidence that certain cortical areas had made advances on the Java brain. The Peking skull

[1] See "Preliminary Notice of the Discovery of an Adult Sinanthropus Skull at Chou Kou Tien", *Bull. Geol. Soc. China*, 1929, vol. 8, p. 207.

shows very decided affinities to the Neanderthal type. In the teeth and jaws, and in that region of the skull which surrounds the ear, we find leanings towards the modern type of man. In brief, in Peking man we have before us a very primitive and generalized type of humanity, combining characters of several known species of mankind. We can explain such a combination of characters only by accepting the theory of man's evolution. Sinanthropus appears to represent one of the earliest and most generalized forms of humanity known to us at present. The

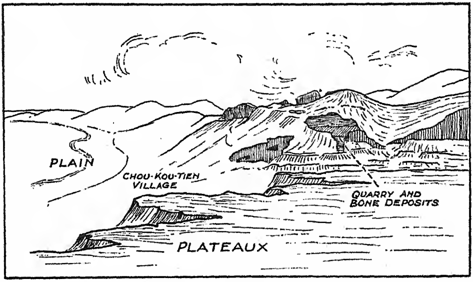


FIG. 88.—A sketch of the hill at Chou Kou Tien in which the Peking skull was discovered. The face of the quarry which has been opened in the hill looks towards the north-east. (Teilhard and Young.)

position to be assigned to Sinanthropus is depicted graphically in fig. 96, p. 293. There his point of emergence from the phylogenetic tree is set between the place assigned to Pithecanthropus on the one hand and that given to Neanderthal man on the other.

Before entering upon a description of the skull, let us glance at the site of discovery—the mining village of Chou Kou Tien, situated 37 miles to the south-west of Peking[1] and at the foot of the Western Hills (fig. 88). To the south of the hills lies a wide expanse of

[1] For an account of Chou Kou Tien and its Fossiliferous Deposits, see an account by P. Teilhard de Chardin and C. C. Young, *Bull. Geol. Soc. China*, 1929, vol. 8, p. 173.

flat land, the Hopei Plain. The hills, which are of no great height, are made up of Ordovician limestone and have been extensively quarried for lime and for coal. The hill with which we are mainly concerned is shown in fig. 88, taken from the report by Father Teilhard and Mr. C. C. Young. This hill—which contains the bone deposits—stands apart and rises scarcely 200 feet above

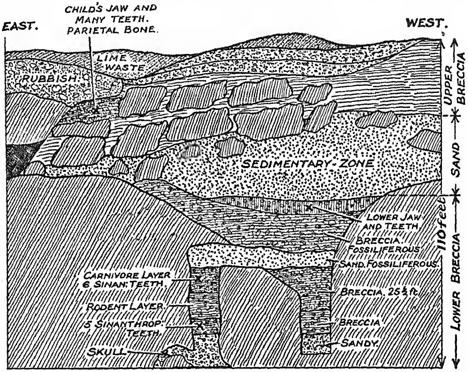


FIG. 89.—A diagram to show the nature, order and number of strata of the fossiliferous deposits in the hill at Chou Kou Tien. Sites of discovery marked X. A, gave lower jaw; B, child's jaw; C, 6 teeth (in northern fissure); D, 5 teeth; E, skull. Further explanation in the text. (After Teilhard and Young.)

the adjacent valley. On the north-eastern aspect of the bone hill has been opened a limestone quarry, exposing on its working face deposits which have accumulated in a great series of caves or fissures. At one time the hill had been penetrated with passages, fissures and caves from top to bottom. In the foreground (fig. 88) is seen the edge of the plateau on which the hills are set, with the village of Chou Kou Tien to the left; the neighbouring river and plain are seen beyond the village. The

bone deposits on the working face of the quarry are shown in fig. 88, as made up of three zones; an upper, middle and lower, with a total depth of over 110 feet (fig. 89). On the exploration of this bone deposit—one of the richest and most extensive in the world—the sinanthropic searchers had toiled for three seasons (1927, 1928, 1929). As we have just seen, the skull was discovered at the close of the third season's work, almost at the base of the deposits.

As the excavators proceeded they found, as has just been stated, that the bone deposits of the hill were divisible into three great zones (fig. 89), an upper, middle and lower. The middle zone, about 22 feet in depth, had been laid down in water; it was made up of sands and loams and was sterile. When this zone was deposited the cave was not frequented by either man or beast. The upper zone—24 feet in thickness—was made up of a great hard conglomerate, a breccia, in which were embedded great blocks of limestone, showing no regularity in its stratification. The limestone blocks embedded in it may well represent the collapsed roof of the original cave. With one exception the upper zone was unproductive. This exception was a fossiliferous deposit at its eastern end (fig. 89) probably an accumulation formed within a small and secondary cave. It was in this site, known as site "B", that Dr. B. Bohlin found the lower jaw of the sinanthropic child (fig. 79, p. 259) and several isolated teeth during the second season (1928).

Under the middle or sedimentary zone comes the lower zone made up of a series of six strata, having a total thickness of 64 feet. The upper stratum of the lower series (fig. 89), a hard breccia, in which clay is mixed, may be regarded as representing the floor of the cave—before it became filled with sediment. It was this uppermost stratum (see fig. 89) of the lower zone which gave the original molar tooth (1927), the adult jaw (see fig. 78) and several isolated teeth—these being found during the second season's work (1928). Below this sinanthropic stratum the main cave, as it

descended, contracted in size until it formed a wide shaft or fissure, known as the "Southern fissure" (fig. 89). Mr. Pei dug through the strata filling the southern fissure, until a depth of 110 feet was reached. All the strata contained fossil remains of animals, but no trace of man was seen. In June 1929 Mr. Pei began the excavation of another offshoot of the main mass—the "Northern fissure" (fig. 89). The strata encountered were counterparts of those of the southern fissure. Like them they were composed of firmly consolidated breccia, rich in fossil fragments. Two of the strata, one named the carnivore layer (fig. 89), yielded teeth of Sinanthropus Then, as already told, he found a filled-up accessory chamber or cave opening off from the lowest stratum of the northern fissure. In the deposits of this cave he found the skull of Sinanthropus (fig. 89) and also that of an extinct species of rhinoceros.

How are we to interpret this vast mausoleum of ancient China? In its strata were found fossil remains of sixty species of mammals, most of them representing extinct forms.[1] How did such an assemblage of animal remains come to be buried in the quarry at Chou Kou Tien? Buffaloes and deer do not live in the recesses of caves, nor does the rhinoceros; yet their skulls, almost intact, were found in the deposits of the caves. They could not have been washed in; they were carried in—but how? Remains of hyaenas occur—of an extinct species—and also of the sabre-toothed tiger, wolf and bear, but it seems to me more probable that it was Sinanthropus, rather than the carnivores, which must be held responsible for giving Chou Kou Tien so full a representation of the fauna of ancient China. His remains occur in all brecciated deposits within the hill; Sinanthropus was living in the neighbourhood when the deepest and oldest deposits were being laid down. Such extensive formations must have taken a long time to form, yet it is the same fauna throughout; the uppermost breccia belongs to the same early pleistocene period as the deepest and oldest.

[1] See Teilhard and Young, reference on p. 277.

Never before have human remains of man been found with such a strange assemblage of animals around them. To account for all the facts—geological and zoological—we must suppose that a form of man was frequenting the cave at Chou Kou Tien at the very beginning of the pleistocene period—which, on the moderate reckoning employed in this work, gives him an antiquity of a quarter of a million years.

In the deposits which have accumulated in caves occupied by Neanderthal man we usually find traces of charcoal—signs of fire and of old hearths. Fossil animal bones when found usually show signs of having been broken open; in such caves we come across a plentiful assortment of stone tools. In the filled-up caves of Chou Kou Tien none of these things were met with. Fragments of white quartz occurred in the deposits; they may have been used as tools, but they had no trace of man's handiwork on them. Not a sign of a hearth was encountered. Was Sinanthropus, then, fireless and toolless? Have we reached at Chou Kou Tien a point in the history of man when the production and use of fire were unknown and the shaping of tools undiscovered? The evidence, so far, is purely negative. A much wider search will have to be made of the early pleistocene deposits of China before such suspicions become certainties.

Having thus laid before my readers what is known concerning the life and times of Peking man (Sinanthropus), I shall now proceed to give a brief account of his skull. The sutures are perfectly open, so we may infer that the specimen found is that of a young individual who has just reached adult years. The cranial walls are of moderate thickness varying, along the vault and sides, from 6 to 9 mm. Until other specimens of this extinct form of man are discovered, the sex of the one found must remain uncertain. Professor Davidson Black is inclined to regard the skull found as that of a woman, but in the present state of knowledge it seems to me—especially when we consider the massive supra-orbital

torus—safer to look upon it as that of a young man. In fig. 90 the Peking skull is represented in true profile. As regards length it fits within the standard—190 mm.—used for modern European skulls. That it reaches such a length is due to two circumstances—first, the great development of the supra-orbital torus in front, and secondly, because of the angulation and backward projection of the occipital bone. I estimate from the photographs supplied to me by Professor Davidson Black that

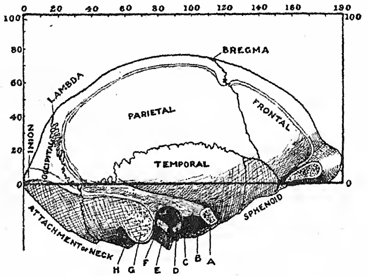


FIG. 90.—The skull of Sinanthropus viewed in true profile. It has been oriented on the subcerebral plane and placed within the standard framework of lines—190 mm. long and 100 mm. high—which takes European skulls of average size. Further explanation in text.

of the total length of the Peking skull 162 mm. represents brain space, the remainder, 28 mm., being made up of the frontal and occipital bony walls. The bony walls make up nearly 15 per cent. of the total length. In the skull of Pithecanthropus the front and hinder bony walls are almost of the same thickness as in Sinanthropus, but the Java brain is shorter, measuring only 154 mm.—8 mm. less than the Peking brain. In Neanderthal skulls the bony elements of their length varies from 14 to 16 per cent. Thus in the proportion of bone and brain elements entering into the length measurement of the skull, Sinanthropus does not differ from

Pithecanthropus and Neanderthal man ; it falls far below the primitive state found in the skull of the gorilla and also in that of Rhodesian man.[1]

Thanks to its bony outgrowths, the Peking skull reaches the full human standard as regards length; in width its basal parts measure 145 mm.—also a full human dimension. We turn now to the third dimension, the height of the roof or vault. As the brain expanded, in the course of evolution, the roof of the skull was raised and the side walls became filled out. When a modern skull of average size is oriented on the subcerebral plane, as in fig. 90, we expect the highest part of the roof to reach the 100 mm. horizontal; the vault of the Peking skull falls short of this standard by 24 mm.; its highest point rises only 76 mm. above the subcerebral plane, only 2 mm. more than in Pithecanthropus. The Gibraltar skull, the lowest pitched and smallest brained of all known Neanderthal specimens, has a height of 86 mm.; in the Rhodesian skull, which represents a very primitive type of man, the same measurement is 95 mm. Or, if we choose to measure the height of the vault above the ear passages, then the dimension we obtain for the Peking skull is equally low, namely 92 mm., compared to 98 mm. in the Gibraltar skull and 107 mm. in the Rhodesian skull. As will be explained later, the auricular height of the vault in Java man was rather greater than in the Peking man. From these figures we infer that the brain of the Peking man was only a little larger than that of the Java man—the smallest-brained of all known forms of early man. The cranial capacity of the Java man is now admitted to have been at least 900 c.c.—perhaps 930 c.c.; that of the Peking man just reached—as regards mass—the lowest standard for modern humanity, about 1000 c.c.—340 c.c. less than in the average male Australian aborigine. In mass of brain, then, Peking man represents a true dawn-form of humanity.

We obtain further light on the lowly status of the

1 The reader will find this matter discussed in *Antiquity of Man*, vol. 2, p. 386.

Peking man when we view his skull from above (fig. 91, A), especially when we compare such a view with the corresponding aspect of the Java skull (fig. 91, B). The Peking skull is the longer and wider, the proportion of width to length—its cephalic index—being 76 against 73 in the Java skull. Particularly interesting is the width of the forehead, as measured between the temporal lines (fig. 91, A, A); in Pithecanthropus this frontal width is only 84 mm.; it is slightly less in Sinanthropus—83 mm.,

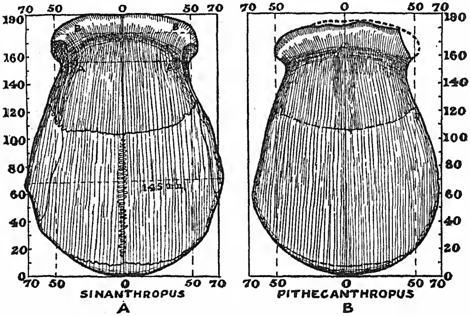


FIG. 91.—(A) The skull of Sinanthropus viewed from above, and set within a standard frame of lines 190 mm. long and 140 mm. wide. (B) The skull of Pithecanthropus from the same point of view.

whereas a common measurement in modern skulls is 98 mm., while in most Neanderthal skulls it is usually well over 100 mm. In primitive human skulls the supra-orbital width greatly exceeds the smallest frontal width. In the Peking skull the supra-orbital width is 109 mm.—6 mm. more than in the Java skull, but 10 mm. less than is usual in Neanderthal skulls and 20 mm. less than in the Rhodesian skull. At its widest the frontal bone of Sinanthropus measures 109 mm. Thus in its supra-orbital width, and in the relation of this width to other frontal measurements, the Peking skull stands very near

to the Java skull. On the other hand, the form of the supra-orbital torus is exactly that met with in Neanderthal skulls. The supra-orbital torus of the Java skull is very imperfectly preserved, but all the indications point to the torus as having had the same form as has been preserved in the Peking skull.

An examination of the occipital aspect of the Peking skull throws light on the primitive nature of Sinanthropus (fig. 92, A). When the skull is oriented on the subcerebral plane and viewed from behind we are struck by the width of the basal part to which the neck is

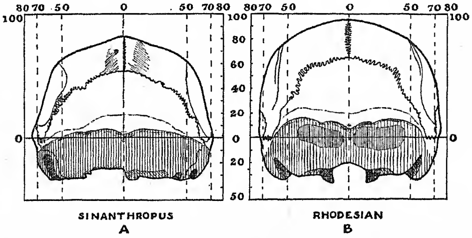


FIG. 92.—(A) The occipital aspect of the Peking skull—the skull is oriented on the subcerebral plane. (B) A corresponding view of the Rhodesian skull.

attached; it measures 145 mm. We notice that the occipital bone is very wide—132 mm. as measured by callipers, but it is short and very low. The upper tabular part—which lies above the attachment of the neck—measures only 51 mm., 9 mm. less than is usual in Neanderthal skulls, but 20 mm. more than in Pithecanthropus. The shortness of the upper part of the occipital bone is the result of lowness of vault and of smallness of brain; so is the condition represented by the parietal bones; as they ascend on the sides of the skull they draw in rapidly. In fig. 92, B, is represented the occipital aspect of another primitive skull—the Rhodesian. The base has the same width as the Peking skull, but owing

to the great increase of the Rhodesian cerebral hemispheres the parietal bones have become filled and expanded outwards so that they form a large area of the occipital aspect of the skull. In the skulls of modern races the parietal bones have expanded still more, while the occipital bone has lost in width but gained in height. The lowest known human condition is presented by the Java skull. Nevertheless, Sinanthropus in its occipital characters stands much nearer to Pithecanthropus than

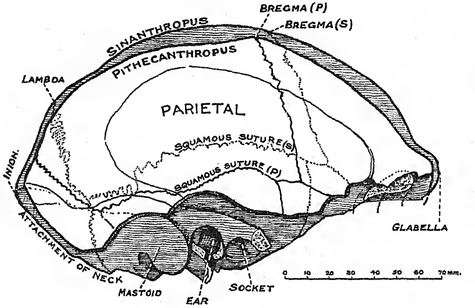


FIG. 93.—The skull of Pithecanthropus, superimposed on that of Sinanthropus, so that occipital and frontal ends correspond.

to Rhodesian man. The occipital view of the Peking skull emphasizes the very lowly position of Sinanthropus in the scale of human evolution. The width of skull, measured between the lower borders of the parietal bones, is almost the same in the Peking as in the Java skull, viz. 133 mm.

Late in the summer of 1930, when Prof. Black had completed his examination of the skull just described, he turned his attention to the other fossil remains found in the previous year—particularly to those from site D in the northern fissure (see explanation to fig. 89). From this site he obtained five worn teeth of the sinanthropic type

and also parts of a skull. When these were fitted together there emerged a second representative of the ancient race. The first skull was clearly that of an individual not quite mature, whereas the second skull was fully adult with much more prominent supra-orbital ridges than the first and with a more receding forehead. In length the second skull—owing to its greater supra-orbital ridges—measures rather more than the first; its width is the same, but the vault is higher; it rises to a height of 84 mm. above the subcerebral plane—8 mm. more than in the youthful specimen. Notwithstanding its adult state the bones of the vault are thinner than in the original specimen, and its cranial capacity is also greater—probably 1100 c.c. Unfortunately the occipital bone and greater part of the temporal are missing.

Of all early types of humanity known to us the one which most nearly resembles the Peking man is the man of Java—Pithecanthropus, and yet when we make an exact comparison—as in fig. 93—of the original Peking and Java skulls, amidst the resemblances, strange differences become evident. In both, the part of the skull to which the neck is attached bends sharply downwards and forwards under the vault, so that the occipital bone becomes angulated—as is also the case in the Rhodesian skull and to a less degree in Neanderthal skulls. When superimposed as in fig. 93, the angulated occipital end of the Peking and Java skulls correspond closely. The supra-orbital torus of the two skulls are also placed at the same level. When such a superimposition is made, the vault of the Peking skull, in the parietal and frontal region, rises 4 to 5 mm. above the corresponding parts of the Java skull—apparently signifying a greater expansion of brain in Sinanthropus. But when we look at the lower border of the parietal bones—along the squamous sutures (fig. 93)—we see that instead of corresponding, the squamous suture of the Peking skull lies 4 to 5 mm. above that of the Java skull. If we superimpose the skulls, parietal bone on parietal bone, then nearly all the brain superiority claimed for Sinanthropus over Pithecan-

thropus disappears. In fig. 93 the skulls are superimposed on Schwalbe's plane.[1] I have pointed out many times before how misleading this plane may be if used as a basis of comparison. As regards brain mass, Sinanthropus stands very little above Pithecanthropus. Both are dawn-forms of humanity.

Here is the proper place to touch on another feature in which the Peking and Java skulls resemble each other. In the occipital view of the Peking skull (fig. 92) it will be observed that the two parietal bones—where they meet in the middle line of the vault—rise up so as to form a ridge. There is a median ridge also in the anterior part of the vault—in the frontal region. Now similar ridges are very distinctly marked in the Java skull; particularly is this the case at the bregma, which forms the highest point of the Java vault. The cause and significance of these ridges are discussed in a later chapter (XXXI); here it is sufficient to say that these ridges and other eminences on the vault are not due to brain substance, but to a particular development of a fluid system connected with the brain.

In the Java skull that part of the temporal bone (both right and left) which contains the ear passage and also carries the mastoid process and, at the same time, provides a socket for the lower jaw are missing, and we have often speculated as to the form which had been taken by them. These missing parts are present in the first Peking skull, and we may well suppose that the Peking and Java skulls agreed in the temporal region of the skull as much as in the cccipital, parietal and frontal regions. As Professor Davidson Black has realized, the temporal region of the Peking skull shows a stage in the evolution of parts seen in modern man. The mastoid process in size and form shows a state half-way between that seen in the skulls of anthropoid apes and modern man (fig. 90, G). The Peking mastoid is not unlike that seen in the skull of a modern child in the second or third year of growth. The floor of the ear passage, formed

[1] See *Antiquity of Man*, vol. 2, p. 580.

by the tympanic plate (fig. 90, E) is also in an intermediate stage—partly anthropoid, partly modern—more so than is the tympanic plate of Neanderthal skulls. It also resembles the tympanic plate of a modern child's skull in that it is divided by a deep fissure into anterior and posterior parts[1] (fig. 90, D, F). The socket for the lower jaw is fashioned not as in the anthropoid ape and as in Neanderthal man, but as in modern man (fig. 90, B).

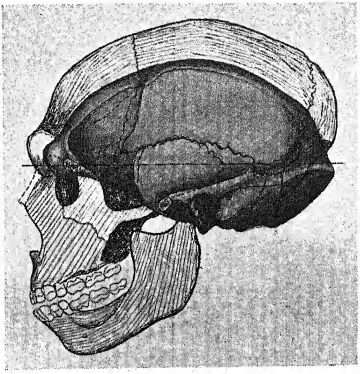


FIG. 94.—Profile of the original Peking skull superimposed on the largest known of Neanderthal skulls—that of the man of La Chapelle-aux-Saints. The skulls have been superimposed so that the ear passages correspond.

This was also the case in Piltdown man, in him the temporal region was wholly modern.

Sinanthropus represents a form of humanity which lived in Eastern Asia at the very beginning of the pleistocene period; the man of La Chapelle-aux-Saints, the largest-brained member of the Neanderthal species known to us, lived in Europe at a much later time. If we allow 250,000 years for the duration of the pleistocene, then

[1] This is also the case in the tympanic plate of the Gibraltar child (see p. 347).

we must suppose that four-fifths of that period—200,000 years—separates the lifetime of the one from that of the other. Both had skulls with low flat roofs, both had the same massive development of the supra-orbital ridges. It is therefore of interest to compare the Peking and La Chapelle skulls. In fig. 94 their profiles are superimposed so that the ear passage of one falls upon that of the other and the supra-orbital torus of the one is at the same level as in the other. The La Chapelle skull is the more massive in every respect, its vault rises 22 mm. above that of the Peking skull. There is, however, a curious discrepancy between the hinder ends of the two skulls. That of the La Chapelle skull, as in all Neanderthal skulls, rises well above the subcerebral plane, carrying with it the attachment of the neck, whereas in the Peking skull, as in that of Java, the occipital end is low and the neck is attached below the subcerebral plane. In estimating the brain capacity of the Peking skull, allowance must be made for the greater fullness in its lower occipital region. Even when this allowance is made, it is evident from fig. 94 that the brain of La Chapelle man was overwhelmingly larger than that of Peking man. The cranial capacity of the La Chapelle skull measured 1625 c.c., at least 600 c.c. more than in the youthful Sinanthropus. We know that La Chapelle man had a brain much above the average for his race, and it may be that the representative of sinanthropic man found at Chou Kou Tien had an exceptionally small brain, but when we make all allowance on this score, we must assume that human evolution has proceeded at a rapid rate to transform a brain such as that of Sinanthropus into the great organ found in La Chapelle man in the course of 200,000 years.

The most surprising feature of Sinanthropus is the smallness of his brain. Does he represent in this respect the stage in evolution reached by humanity at the end of the pliocene or beginning of the pleistocene period? In size and conformation of brain, Sinanthropus of China rose little above his contemporary in Java—Pithecan-

thropus. So small and lowly was the brain of the latter, that we have been in the habit of regarding him, not as a representative of contemporary humanity, but as a non-progressive survival which had retained an ancestral type of brain.[1] But now, with the Peking skull before us we have to reconsider the problem. Were, then, the Peking and Java men representative of early pleistocene

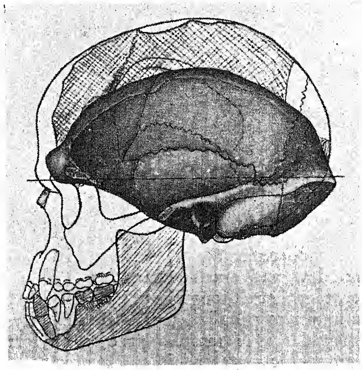


Fig. 95.—The skull of Sinanthropus superimposed on that of Eoanthropus (Piltdown man). The outline of the Piltdown skull is reproduced from fig. 252, p. 591, vol. ii, *Antiquity of Man.*

humanity in their development of brain? If so, then evolution must have proceeded rapidly to produce the many large-brained types of men who lived in Europe in the latter third of the pleistocene period. Or it may be that we underestimate the duration of the pleistocene period. Even if we ascribe to it a duration of a million years, evolutionary changes which converted the brain of Sinanthropus into that of La Chapelle man must have proceeded rapidly.

[1] See discussion, *Antiquity of Man,* vol. 2, p. 436.

Before we finally accept the brain development of Sinanthropus as representative of early pleistocene humanity, let us make another comparison. There was living in England, at the opposite end of the Old World, and early in the pleistocene period, a western type of man, known to us by the skull found at Piltdown in Sussex. In fig. 95 the profile of the Peking skull is superimposed on that of Piltdown—in exactly the same manner as when we compared it with the La Chapelle skull. As regards length and breadth of base, the two skulls measure nearly the same, but the Piltdown skull, early pleistocene in date, is high vaulted, rising 25 mm. above the Peking vault. We must make an allowance for the great thickness of the walls of the Piltdown skull; the vault of the Piltdown skull is about 10 mm. thick, 2 to 3 mm. more than in the Peking skull. Nevertheless, the Piltdown brain-space was much the greater, at least 300 c.c. more; in my estimate, 400 c.c. more. Thus at the western end of the Old World there was a form of humanity with a brain which, in point of size, reached almost the modern standard, while at its eastern end there were low and small-brained types. We have to remember, too, that although in certain cranial characters Piltdown man was peculiar, yet in the majority of them—in form and size of mastoid process, in form of ear passage, tympanic plate and in the conformation of the socket for the lower jaw, as well as in shape of cranial bones and sutures—he had the most intimate resemblances to modern man. Thus in the early part of the pleistocene period there seems to have existed a higher type of man at the western end of the Old World than at its eastern end. Geological and archaeological evidence support the inference drawn from anatomical evidence. In geological deposits of late pliocene and early pleistocene date of East Anglia, Mr. Reid Moir has discovered stones which show on them definite signs of human workmanship.

Thus in the fossil human skulls, found at a depth of 110 feet in deposits which accumulated in a cave at

Chou Kou Tien, when the fauna of China was very different from what it is to-day, we find a strange assortment of characters. The greatest number of these link these ancient Chinamen to the Pithecanthropic type of Java; other features link them to the Neanderthal type of

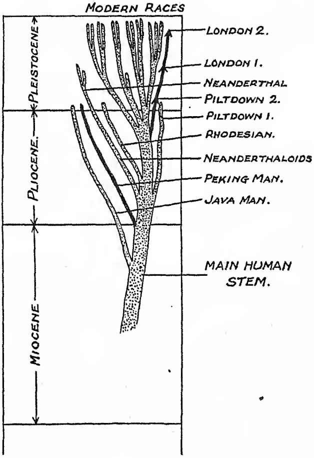


FIG. 96.—A diagram to indicate the position of Sinanthropus in the phylogenetic tree of human evolution (see also frontispiece).

Europe; yet others reveal affinities to modern man. To account for such an assemblage of characters, we derive Sinanthropus from the main stem of evolving humanity near the points at which we suppose the ancestry of Java man and Neanderthal man began to part company with the ancestry of modern races. His place is given a diagrammatic representation in fig. 96 and in the frontispiece to this volume. The separation of the

sinanthropic stem must have been initiated early in the pliocene period. Whatever the future may reveal concerning the pedigree of Sinanthropus, there can be no doubt that the discovery of this primitive type is one of the most important events which have marked the opening-up of man's early history.

CHAPTER XIX

JAVA, AUSTRALIA, AMERICA

The Cohuna Skull

We have made a long journey in our pursuit of ancient man. The trail we have followed in the previous eighteen chapters has carried us along Africa, from Cape Colony to Egypt, and then across Asia, from Palestine to North China. And now, before returning to Europe, where many important discoveries await our attention, we must pay hurried visits to Java, Australia and America and note the additions which these countries have made to our knowledge of ancient man since I made my last survey (1924). Just as my proofs were then passing through the press, Dr. Eugene Dubois made two brief but very important communications[1] concerning the man of Java, *Pithecanthropus erectus*, the fossil bones of whom he discovered in 1891–92 and which are now preserved in the Teyler Museum, Haarlem. After much painstaking labour, he had succeeded in freeing the interior of the skullcap from all concretion and had thus exposed the clear impressions made on it by the brain. He had taken a cast from its interior which reflected in sharp definition the more important external features of the brain of Pithecanthropus. He also produced a most important fossil fragment, part of a lower jaw which he had found in 1890, not in the fossiliferous bed at Trinil, but in a contemporary bed at Kedung Brubus, 32 miles to the east of the famous site. Of the skullcap, the endocranial cast, the three original teeth (a first left lower premolar, an upper left second molar and upper right third molar), the thigh bone and mandibular fragment, he reproduced photographs, which conveyed a much clearer expression of their anatomical features than all previous illustrations.

1 *Proceedings of the Royal Academy of Science, Amsterdam*, 1924, vol. xxvii, Nos. 3, 4, 5, 6. See also *Antiquity of Man*, vol. 2, p. 427.

Dr. Dubois published his original monograph on Pithecanthropus in 1894. His second communication was made in 1924. In the intervening thirty years much had happened. Piltdown man had been discovered; so had Heidelberg man and Rhodesian man; our knowledge of Neanderthal man had greatly increased. These discoveries confirmed Dr. Dubois in his original contention that there should be no hesitation in assigning to the same individual a thigh bone, altogether human in its characters, and a skullcap which was ape-like. All that had happened since he published his original monograph had confirmed the truth of Darwin's theory of man's origin and revealed the fact that when we went back to early pleistocene times the representatives of humanity show strange and diverse blends of simian and human features in their anatomical composition. In 1924 he did not find it necessary to defend the assignment of the Trinil femur to Pithecanthropus. Nevertheless, he had reason to alter his original conception of Pithecanthropus; the additional facts he had elicited compelled him to recognize the essential humanity of this fossil form. The length of the skull, when in its living state, he now estimates to have been 184 mm.; of this measurement the bony walls of the skull made up 30 mm., and the brain space 154 mm. The brain space made up 84 per cent. of the total length, the same proportion as is met with in some Neanderthal skulls. So thick are the bony walls in the Rhodesian skull that the brain space forms only 81·4 per cent. of its total length; in modern man the brain proportion is 92 per cent., while in male adult gorillas it is only 73 per cent. Thus in the length dimensions of the skull, both absolute and relative, Pithecanthropus was human. The width of the skull Dr. Dubois now determined to be 131 mm.,[1] which is 71 per cent. of the length—a dolichocephalic skull. The width of the brain was 124 mm., which is 80 per cent. of the brain length; in brain-form Pithecanthropus falls into the round category. As regards size

[1] An exact estimate made from the cast convinces me that at its base the skull must have measured at least 138 mm., the lower parietal width being 133 mm.

of brain, Dr. Dubois found a revision of his original estimate necessary; he raised the capacity from 855 c.c. to 900 c.c. When he obtained a perfect brain cast from the interior of the skull, he recognized at once that the convolutionary markings were very primitive and yet essentially human—not anthropoid. As to the inferences which Dr. Dubois drew from the study of the endocranial cast, and those which others have drawn since the cast became accessible to anatomists, I shall deal with them in a subsequent chapter devoted to the consideration of

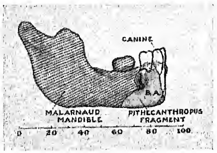


FIG. 97A.—The Kedung Brubus mandibular fragment set within the Malarnaud (Neanderthal) mandible.

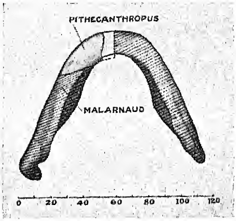


FIG. 97B.—The mandibular fragment shown in fig. 97A, viewed from below. It is set upon the Malarnaud (Neanderthal) mandible.

the brain development in ancient human types (Chapter XXXI).

If Dr. Dubois is right in attributing the Kedung Brubus fragment of the lower jaw to Pithecanthropus—and in my opinion he is justified by the evidence—then that fossil being, in spite of an ape-like skullcap, was more human in tooth and jaw than we have hitherto believed. A drawing of the mandibular fragment, with Dr. Dubois's restoration of the missing parts of the chin region, is reproduced in fig. 97A. All its characters are human, not anthropoid. The fragment still carries the first lower premolar; this tooth, although smaller than the corresponding tooth found at Trinil, resembles the original in structure of root and crown. The original

tooth had a crown which measured 8·2 mm. in width and 7 mm. from front to back, both diameters being quite common ones in the dentitions of living primitive races. The Kedung Brubus premolar is slightly wider (8·4 mm.) but shorter from front to back (5 mm.). Enough of the socket of the canine is preserved to prove that the tooth contained in it was human in size and shape (fig. 97). The root was only 14 mm. long; its width 7·5 mm.; it was compressed from front to back, its diameter in this direction being merely 5 mm. The most striking feature of the fragment is the clear evidence it affords that already in this early man of Java the alveolar and basal elements of the mandible were becoming differentiated and that a true although peculiar chin was in process of formation. The form of the symphysis was not materially different from that seen in the mandible of Sinanthropus (see p. 265); although the actual chin is missing, the basal bar which goes forward to join the mental eminence and form the chin has a pronounced development (fig. 97A). Along its wide, flat, lower surface (fig. 97B) there is an extensive area for the attachment of the digastric muscle. The attachment of this muscle was human, not anthropoid. The mandible was not massive; its height in the premolar region was 30 mm.; the depth of the symphysis may be estimated at 33 mm. In all of these points the man of Java was more human than the contemporary forms of Europe—such as the Piltdown and Heidelberg types. In the former the mandible retained the simian shelf and a simian canine; in the later, although the canines were human, yet the chin region was modelled on anthropoid lines.

To those who have investigated the anatomy of the anthropoid apes such a combination of human and anthropoid characters as are met with in Pithecanthropus is in nowise surprising. The anthropoid body is a mosaic of structures; while those of one system have become modified in one direction, those of another system have retained an ancient form or moved in a contrary direction. Only those who began their investigations under the

belief that all parts of the body became simultaneously modified and that all modifications moved in a corresponding direction, find a difficulty in the interpretation of the finds made at Trinil, at Piltdown and in Rhodesia. Because the combination of parts does not answer to their anticipations, they would divide the fossil remnants among diverse animals, assigning the skull to one kind, the thigh bone to another and the teeth and mandible to a third. The right attitude to take up towards the discoveries made at Trinil, Peking, Broken Hill, Heidelberg and Piltdown is not to quarrel with their unexpected revelations, but to accept them as true guides to the manner in which man has risen from an anthropoid to a human status. Nor should there be, in the case of Pithecanthropus, any difficulty in accepting him as human in tooth and chin. It is true that the two molar teeth found with the skull have met with general acceptance as genuine parts of Pithecanthropus; they are large-crowned and strong-rooted. The second upper molar has a crown which is 13·8 mm. wide and 12 mm. from back to front; the corresponding measurement of the third upper molar are 15·3 mm. and 11·3 mm. The roots of the molars, although more divergent than those of Sinanthropus, have the same short, straight, stumpy form. In Sinanthropus we have seen that the crowns of the molar teeth show certain degenerate—non-anthropoid—changes in their cusp development. The cusps of the molar crowns of Pithecanthropus, although massive, manifest a remarkable form of degeneration, a form which is human, not anthropoid. I mention these facts to emphasize the essential humanity of Pithecanthropus and to justify the step taken by Dr. Dubois when he added the Kedung Brubus mandible to the list of authentic documents pertaining to this strange human form.

The new data relating to Pithecanthropus supplied by Dr. Dubois have given rise to fresh studies and also new and better-founded attempts to reconstruct the missing parts of skull and face. I will mention here only the two more important reconstructions—one made by Dr. J. H.

McGregor[1] of the American Natural History Museum, New York, the other by Dr. Hans Weinert[2] of Berlin. Dr. McGregor, using data supplied by other fossil skulls of early man and by the skulls of anthropoid apes, has added to the endocranial or brain cast its missing parts. The model thus made, which attains as near to the original as is now possible, has a volume of 940 c.c.—40 c.c. more than in Dr. Dubois's estimate. Thus in Dr. McGregor's reconstruction the brain of Pithecanthropus attains a volume equal to that of the lowest human record—that of an aboriginal Australian woman. In Dr. Weinert's reconstruction the volume has risen to 1000 c.c. My own investigations have led me to the conclusion that Dr. McGregor's estimate is the utmost that can be allowed. Thus in size of brain the Trinil individual had reached what has become the lowest limit amongst primitive races of mankind.

With the exception of Dr. Dubois's original monograph, that published by Dr. Weinert is the most important contribution yet made to our knowledge of Pithecanthropus. He had the advantage of studying the original fossils, and has interpreted the data thus obtained in the light of modern anatomy. In fig. 98 I have reproduced his reconstruction of the skull of Pithecanthropus. The parts actually found are shaded; the rest—the stippled areas—are inferred. The skull is oriented on the Frankfort plane (fig. 98, O, O). On this has been raised a framework of lines 115 mm. high and 190 mm. long. These dimensions have been chosen because when the skull of an Englishman, with a head slightly above the average in size, is placed in such a frame the vault attains the 115-mm. level, while its forehead reaches the 190-mm. vertical. The height of the vault in this reconstruction of Pithecanthropus is only 94 mm. high; it falls short of the English level by 21 mm. If we orient the skull on

[1] J. H. McGregor, "The Skull and Brain of Pithecanthropus", *Natural History*, 1925, vol. xxv, p. 144.

[2] Hans Weinert, *Pithecanthropus erectus*, Berlin, 1928. Also published as a monograph in *Zeitsch. f. Anat. und Entwickl.*, 1928, vol. 87, parts 3, 4.

the subcerebral plane, the one usually adopted by me in the case of fragmentary skulls (see p. 282) the height of vault is 76 mm.—24 mm. less than in the skull of an average male European. Pithecanthropus had, until the discovery of Sinanthropus, by far the lowest vaulted of fossil human skulls. As regards total length, the skull falls only 6 mm. short of the modern standard adopted in fig. 98. It attains this length in an illegitimate

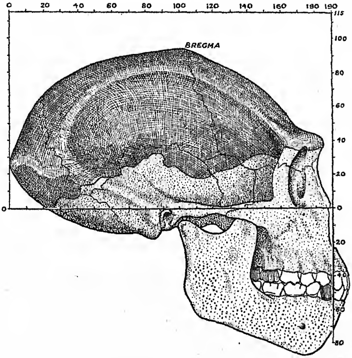


FIG. 98.—Dr. Weinert's reconstruction of the skull of Pithecanthropus. The parts actually known have been shaded. The skull is oriented on the Frankfort plane (O, O), and on this base a framework of lines has been raised, 115 mm. high and 190 mm. long—dimensions which accommodate the skull of an average Englishman.

manner, by reason of the great development of the supra-orbital ridges. When the thickness of the frontal wall is measured, from glabella to brain-chamber, it is found to be 24 mm.—10 mm. more than is usual in Europeans. Were we to reduce the supra-orbital shelf to modern dimensions, the skull of Pithecanthropus would fall not 6 mm. but 16 mm. short of the length of our standard frame. When we remember its limited width (131 mm.), its low roof (94 mm.) and deduct 10 mm.

from its length on account of the supra-orbital ridges, we realize how small was its brain-containing capacity. As I have said, Dr. McGregor's figure, 940 c.c., is above rather than below the mark.

The sutures of the skull, as depicted in Dr. Weinert's drawing (fig. 98), are human in their form and arrangement; the wing of the sphenoid, seen in the temporal fossa, is already great and human in its articulations. In reconstructing the face of Pithecanthropus Dr. Weinert has struck a mean between man and anthropoid. It will be observed that he has placed the ear passage midway along the base, a forward position which gives an anomalous length to the parts behind the ear, particularly of the mastoid part of the temporal. If the ear passage were to be moved backwards a centimetre, all the facial parts in front of the ear would also have to be moved backwards, and much of the anthropoid-prognathism given by Dr. Weinert to the face of Pithecanthropus would disappear and be replaced by a more human-like arrangement of parts. It is not possible to fit the Kedung Brubus mandibular fragment into Dr. Weinert's reconstruction; it is more human in its characters than is the mandible of his reconstruction. This fragment, however, he has deliberately left out of account; Dr. Weinert does not accept it as Pithecanthropoid. If it is not, then there must have been living in the same district of the island of Java and at the same time as Pithecanthropus another primitive race of human beings. By far the more probable inference is that made by Dr. Dubois: in his opinion there was only the one type, Pithecanthropus, which was human in chin, tooth, femur and brain, but in the modelling of its skullcap still retained much of the ape.

Having given the ancient and primitive fossil man of Java our attention and noted the tendency of the expert mind to lay more and more emphasis on his essential humanity, we pass to the continent of Australia. In 1924, when I made my last survey, only one human Australian skull had been found in a mineralized state and in geological surrounding which justified the assumption of

antiquity.[1] This was the skull of the Talgai youth, described by Dr. S. A. Smith in 1918, and now preserved under the care of Dr. A. N. Burkitt, Professor of Anatomy in the University of Sydney. The skull of this lad, who was probably about 15 years of age, was much crushed, but in all its preserved features one could recognize the traits of the aborigines of Australia, the most primitive of surviving racial types. In this Talgai skull was seen for the first time a stage in the evolution of the aborigines of Australia—a stage attained before the end of the pleistocene period of Australia. The exact antiquity of the Talgai skull is still a moot point, but if we regard it as corresponding to the late cave period of Europe and assign to it an antiquity of some 12,000 or 15,000 years, we shall probably underestimate its antiquity. In size of brain the Talgai lad more than holds his own when compared with his modern representation, while in size of palate and of teeth—as we expect in an ancestral type—he greatly exceeded them. Especially was this the case as regards the width of muzzle as measured between the outer surfaces of the upper canine teeth. The width here was originally given as 59 mm.—15 mm. more than is usual in the palates of modern Australian natives. All the teeth, particularly the canines, were large.

There was some doubt as to the position and contacts of the upper canine teeth. Dr. Stewart Smith found on the front aspect of the canine crown—the aspect directed towards the lateral upper incisor, and also on the hinder surface, directed towards the first upper premolar, two facets of wear. These facets led him to infer that the Talgai canines projected beyond the level of their neighbours and in chewing had come into contact with teeth in the lower jaw. Professor Burkitt[2] has succeeded in exposing the Talgai palate and teeth more clearly than before and has re-examined the facets of the canines. He finds they were caused not by the upper canines coming

[1] See *Antiquity of Man*, vol. ii, p. 448.

[2] *Reports of the Hobart Meeting of the Australian Association for the Advancement of Science*, 1928, p. 366.

in close contact with their opponents in the lower jaw, but by their own neighbours in the upper jaw, the upper lateral incisor and upper first premolar. The canines of the Talgai lad, therefore, did not rise as separate members above the level of their neighbours, as is the case in anthropoid apes and in Piltdown man, but were, as in Pithecanthropus, Sinanthropus, Heidelberg man, Rhodesian man and modern man orderly units in a continuous dental arcade. In all other points Professor Burkitt confirmed the description which Dr. Stewart Smith gave

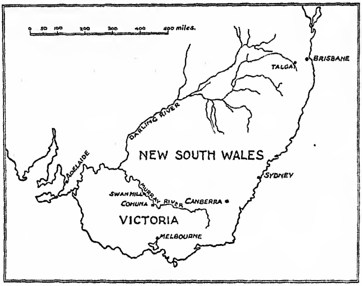


FIG. 99.—Sketch map of south-eastern region of Australia, showing the positions of Cohuna and Talgai.

of the massive palate and teeth. The Talgai molar teeth, almost as massive as those of the fossil man of Java, reveal, according to Professor Burkitt, degenerative changes in cusp development not unlike those to be seen in the molars of Pithecanthropus. One has certainly to keep in mind the possibility of the Australian type being a distant but direct descendant of the ancient fossil type of Java.

We must now make our way from Sydney to the small township of Cohuna to mark the series of events which led to one of the strangest and most unexpected discoveries of fossil man ever made. Cohuna is situated on the great

flat sandy plain through which the Murray River meanders, separating, as it twists, the neighbouring states of New South Wales and Victoria. It is situated on the Victorian side of the plain and is 10 miles distant from the river (fig. 99). Cohuna is now 350 miles distant from the mouth of the Murray, but there was a time—probably in the pleistocene period—when a great arm of the sea extended into the continent, far beyond Cohuna, and covered the length and breadth of the great plain, receiving in its tidal waters the rivers which are now tributaries of the Murray. Thus it has come about that the plain is covered by a layer of silt laid down in the ancient estuary. This deposit is now covered by fine blown sand which, in the neighbourhood of Cohuna, reaches a depth of 1 foot. In recent years the arid plain between Cohuna and the river has been brought into an irrigation scheme. In November 1925, as a channel was being dug across the plain and had reached a point some 2 miles from the Victorian bank of the Murray, a human skull was exposed. The contractor, Mr. G. A. Gray, observed that it lay in the silt, only 2 feet below the surface, here covered by a layer of blown sand about 1 foot in thickness. Often before native burials had been unearthed at various depths, but Mr. Gray observed that this skull—the Cohuna skull—differed in two respects from all he had formerly come across: it was deeply mineralized; it was also more massive in all its parts than the skulls from native burials. No fossil bones of extinct species of animals were seen; no primitive types of human implements were observed; there was nothing to differentiate this skull from others found at the same or at deeper levels of the silt except its fossilized condition and its outward appearance.

My friend Sir Colin MacKenzie, now Director of the National Museum of Australian Zoology established by the Commonwealth Government at Canberra, hearing of the discovery early in 1926, gave it his immediate attention. A cursory examination convinced him that an important discovery had been made and that the Cohuna

skull represented a very primitive and unknown type of humanity. A search by Mr. E. T. Dunn (formerly Government Geologist of Victoria) did not reveal any stratum in the silt of the plain which contained fossil remains of Australian animals of the pleistocene period. The only evidence of antiquity was carried by the skull itself—its structural characters and its mineralized condition.

The announcement of the discovery in the Press gave zest to further search, and from the silt bed of the same area of the Murray plain parts of four other fossilized skeletons were added to the material already at Sir Colin MacKenzie's disposal. These additions resembled the original Cohuna skull in state of mineralization and in their characters differed from bones dug from aboriginal graves in the same locality. The inference I draw from the circumstances of the discovery is that deliberate burials had been made in the plain at some remote period. My reasons for coming to this conclusion are (1) that remains of at least five individuals were found; (2) that in some cases fragments from all parts of the body were present, and (3) that all lay in the same superficial accessible stratum of silt. These prehistoric beings, I conclude, did not become entombed as the result of a flood, but were deliberately buried in the silt.

Sir Colin MacKenzie is preparing a monograph on the Cohuna race, but in the meantime he has been so good as to permit me to use some of his data. He has sent me an exact tracing made along the middle line of the Cohuna skull from the maxillary snout in front to the inion in the nape of the neck behind. This tracing is reproduced in fig. 100; there the outline is placed on that of the restored Talgai skull. The Talgai skull is that of a lad about 15 years of age; it is immature; the supraorbital ridges are not yet fully developed; the upper jaw has still to grow forwards far enough to permit the wisdom molars to come into place. The Cohuna skull, on the other hand, is that of a fully adult man with his eyebrow ridges completely developed and his jaws full-sized. In

the lad the forehead is rounded; in the man it forms a flat shelf, ending in front in massive supra-orbital ridges. Those unfamiliar with the changes which the forehead may undergo—and does undergo in occasional Australian aborigines—may regard this striking difference between the foreheads of the two skulls compared in fig. 100 as due to a racial difference. I can assure them this

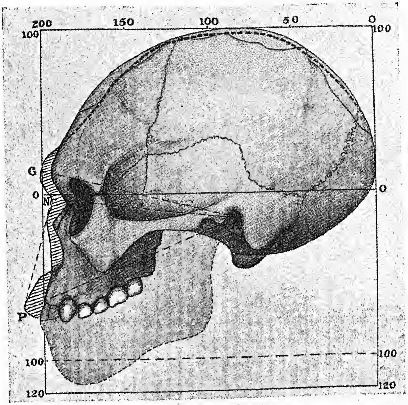


FIG. 100.—A profile of the restored Talgai skull (see *Antiquity of Man*, vol. ii, fig. 159); on this has been superimposed a sagittal tracing of the Cohuna skull. The chief radial measurements—made from the centre of the ear passage—are indicated.

is not the case; no baby was ever born with a slanting forehead; the flattening of the forehead is a change which sets in with puberty, and if the Talgai lad had lived he, too, might have developed a pent-house forehead. When these allowances are made, the correspondence between the Talgai and Cohuna skulls is so exact that I have no hesitation in assigning both of them to the same race. Although Cohuna is 750 miles distant from Talgai

as the crow flies, yet both sites are within the great Murray watershed (fig. 99). Both skulls represent the proto-Australian type out of which the modern aboriginal type has been evolved.

I look upon the Cohuna discovery as most important; it has revealed to us the altogether remarkable facial features of the proto-Australians. No measurements bring out the simian development of their face so well as the distance of the alveolar snout from the ear. In fig. 100 the radial distance of the alveolar border of the upper jaw from the centre point of the ear is indicated (P, A); it amounts to 140 mm., a record measurement for a human skull. This distance in the Rhodesian skull is 124 mm.; it is the same in that massive example of Neanderthal man—the La Chapelle skull; in the Talgai lad, 120 mm.; in the average modern aborigine, 109 mm.; in the negro, 106 mm.; in modern British, 100 mm. The cause of this great forward projection of the snout is to be accounted for by the manner in which the face of the proto-Australian, and also of his modern representatives, tends to grow; as in the chimpanzee and orang, the face or snout tends to shoot forwards, not downwards as in Rhodesian man and in the gorilla. Hence the face of Rhodesian man as measured from nasion to alveolar point is long, namely 94 mm., whereas the same measurement in the Cohuna skull is 70 mm.—only 2 mm. more than in the average living aborigine.

The remarkable prognathism of the Cohuna skull is again brought out when we compare the alveolar radius (A, P) with that drawn to the nasion (A, N, fig. 100). The latter measures 110 mm. in the Cohuna skull, 30 mm. less than the A, P radius. In the modern aborigine the difference is 11 mm.; in British skulls the difference is only 4 mm. No such prognathism has ever before been met with in a human skull—only in those of apes.

Another arresting feature of the Cohuna skull is the distance of the central point of the eyebrow ridges (the glabella) from the ear (fig. 100, G, A). In the male gorilla, Rhodesian and La Chapelle skulls this radius measures

114 mm.; in the Cohuna skull it reaches 120 mm. The distance between the temporal lines on the forehead is small, only 86 mm., against 99 mm. in that of the modern aborigine. The width of the supra-orbital torus is 116 mm.—3 mm. more than is usual in modern aborigines, but 24 mm. less than in the Rhodesian skull. From these important facts there can be no doubt as to the prehistoric status of the Cohuna type, nor is there any justification for looking upon the Cohuna skull as that of an aberrant aborigine which had undergone an unusual degree of mineralization.

When we turn to the palate of the Cohuna man, we find that several anatomical "records" are broken. The Talgai canines were larger in their diameters than any other known in a human skull. The Cohuna canines are still larger. Sir Colin Mackenzie informs me that their crowns measure 12·5 mm. from front to back—2 mm. more than in the Talgai specimens. On the other hand, massive as the Cohuna molars are, they have the same front to back diameters as the Talgai, but are greater in width, namely 14·5 mm., the same as in Pithecanthropus. The total length of the dental arcade is 72 mm.; its width at the second pair of molars 75 mm.; its bicanine width 55 mm.—about the same as in the Talgai palate; the total area of the palate, as calculated in this work, was 46·5 cm.—the largest known in a human skull. I estimated that when fully grown the Talgai palate would have had an area of 40 cm.^{2}; the Rhodesian palate measures 41 cm.^{2}; the average for male Australian aborigines is 31·6 cm.^{2}. Only in male anthropoid apes do we find a palate as large as that of the Cohuna skull. The nose was short (48 mm.) but extremely wide (32 mm.). In all of these facial characters the Cohuna skull stands alone, and yet the differences between its facial parts and those of a modern aborigine are only of degree—not of kind.

We have been discussing the facial characters of Cohuna man; let us now turn to his cerebral outfit. The length of the skull is 199 mm.—7 mm. more than the Talgai skull, but the extra length is due to the thickness

of the glabellar wall of the skull, which in the Cohuna skull measures 23 mm., practically the same as in Pithecanthropus. The Cohuna skull, however, is narrow, only 131 mm. at its widest part, the same as in the Java skull according to Dr. Dubois's measurement; whereas in the Talgai lad the skull width was 141 mm.—10 mm. more. In height of vault the Cohuna and Talgai skulls are almost alike; the vault rises 108 mm. above the ear-holes. We must remember, however, when using the diameters of the skull as a guide to size of brain, that the vault of the Cohuna skull is very thick, namely 12 mm., so that deductions have to be made from both length and height to permit us to apply a formula which holds for estimating the capacity of modern skulls. When such deductions are made we find that the brain volume of Cohuna man was about 1260 c.c.—at least 40 c.c. less than in Rhodesian man and somewhat less than the mean which holds for Australian (male) aborigines. If we classify Cohuna man according to the ratio of his palatal area to brain volume, we find that he takes a low place in an ascending scale. The palatal area is 46·5 cm.; the brain volume 1260 c.c.; there is 1 cm.^{2} of palate to every 27 c.c. of brain volume. It is the lowest human record known; in female chimpanzees the ratio is 1 : 8·7; in Rhodesian man 1 : 31·7; in modern Australian aborigines 1 : 40·8; in modern English 1 : 59·6.[1]

Taking it all and all, the Cohuna skull—with the exception of the Java and Peking specimens, and perhaps of Piltdown—represents the most primitive human form known to us. The discovery of the Talgai skull made us suspect that the continent of Australia has been inhabited from a remote date, probably from a date early in the pleistocene period, and that the modern natives were to be regarded as the descendants of these first primitive invaders. The discovery at Cohuna confirms this suspicion and gives us a picture of the physical and mental development of the Australian natives at a certain stage of their evolution. We must suppose that the trend of

[1] See *Antiquity of Man*, vol. ii, p. 659.

evolution has been towards, not an increase of brain, but towards a marked reduction in size of jaw and tooth. In Europe our ancestral type, represented by Cromagnon man, was stronger-jawed than we, who are his modern descendants. We ascribe the reduction of tooth and jaw to a change in our dietary. A similar and independent change affected the natives of Australia, but can we ascribe the change in their case to an amelioration of diet? I doubt if the diet of the modern aborigine needs less chewing than that consumed by the man of Cohuna.

Our visit to the continent of Australia has repaid us with a surprise, and I would have been satisfied if the great continent of America towards which we now make our way had had an equal reward in store for us. It has not: America still remains an enigma to the student of early man. Indeed, the discovery of Sinanthropus in North China but deepens the mystery, for we now know that the Asiatic end of the land bridge which led to America in early pleistocene times was inhabited, and we cannot understand why man did not cross over then into the New World. If he did, neither the archaeologists nor the geologists of America have found his fossil bones as yet. There is an abundance of evidence that both man and civilization are old in America,[1] but I agree with my friend Dr. Hrdlička that none of the human remains yet discovered in pleistocene deposits of either North or South America indicate a type which differs materially from that which is represented by the American Indian. There is, however, one possible exception—the Punin skull. It was found by an expedition sent out in 1923 to Ecuador by the American Museum of Natural History, New York. The object of the expedition, which was led by Dr. H. E. Anthony, was not to search for remains of fossil man, but to examine the pleistocene fauna which was known to be embedded in a stratum of volcanic ash high in the Andean region of Ecuador just south of the equator. Sections of this fossiliferous bed are exposed on the sides of many ravines cut by torrents in the high

[1] See *Antiquity of Man*, vol. ii, chapters xxiv, xxv.

plateau, and it was while searching the banks of a ravine near the village of Punin that a human skull was discovered. It lay in the fossiliferous stratum; it was, when dug out, in the same state as the bones of the extinct Andean horse, and of the camel and mastodon which are embedded in the same stratum, although not at the same spot. If it had been the skull of any other animal than man, its antiquity would not have been called in question.

When the expedition returned to New York from Ecuador, the skull was transferred to the Anthropological side of the Museum, where it was examined and described by Drs. Louis R. Sullivan and Milo Hellman.[1] Both anthropologists were struck by its resemblance to the skulls of native women of Australia. I agree with them; the points of resemblance are too numerous to permit us to suppose that the skull could be a sport produced by an American Indian parentage. We cannot suppose that an Australian native woman had been spirited across the Pacific in some migratory movement and that afterwards her skull was buried in a fossiliferous bed in the high plateau of Ecuador. The Australian type persists among some of the jungle tribes of Southern India; the type might have reached the Asiatic land-bridge. There is the further suspicion that the Australian aborigine is the descendant of a type not unlike Pithecanthropus or of Sinanthropus. This discovery at Punin does compel us to look into the possibility of a pleistocene invasion of America by an Australoid people.

The Punin skull is that of a woman; a very similar specimen from Australia is depicted in vol. ii, fig. 156 of *Antiquity of Man*. In fig. 101 the Punin skull is shown in profile, oriented on the Frankfort plane and placed within a framework of lines 190 mm. long and 115 mm. high. Its actual dimensions are: Length, 186 mm.; width, 132 mm.; height of vault, 113 mm. Such measurements are met with in the skulls of the native women of Australia, but it is the contour and the modelling of the

[1] *Anthropological Papers of the American Museum of Natural History*, 1925, vol. xxiii, p. 313.

parts, especially of forehead and occiput, which lead the expert to his diagnosis. Its cranial capacity is 1275 c.c. More emphatically are its Australoid affinities manifested in its face. The nose is short (only 42 mm.) and relatively wide (25 mm.). The face itself is very short—only 53 mm. as measured from nasion to alveolar point, and the forward projection which is seen so markedly in the Cohuna skull is also evident. In size of jaws the Punin woman falls far short of the Cohuna man; in the latter the ear-alveolar

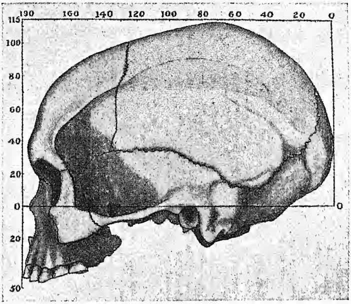


FIG. 101.—The Punin skull as seen in profile; reproduced from the photograph published by Drs. Sullivan and Hellman.

radius measured 140 mm.; here it is only 101 mm., but when we compare the ear-alveolar radius with the ear-nasion radius we find evidence of the forward prognathism of the Australoid type. In the Punin skull the ear-nasion radius reaches 92 mm.; the ear-alveolar radius is 9 mm. more—a measure of its prognathism.

The molar teeth of the Punin woman were massive and Australoid in character. The crown of the first molar measured from front to back is 11·5 mm., from side to side 12·5 mm.; the second molar is only slightly smaller. Strange to say, the third upper molars are absent; they were never formed. Now although the wisdom teeth

frequently fail to form, or if they form fail to erupt, in modern Europeans, we do not expect to find this failure in a primitive human race. Here, however, is an instance to the contrary; nevertheless, the mineralization of the skull, its structural characters and its geological history all point to a high antiquity.

Much of what we know concerning the prehistory of the New World cannot be fitted into the scheme of knowledge which holds for the Old World. Many things remain to be explained, many enigmas to be solved. The discovery of the Punin skull adds another to a long list. It provides an item of evidence which must be kept in mind by those who seek to unfold the early history of man in the continent of America.

CHAPTER XX

DISCOVERIES AT EHRINGSDORF

My readers must not think, because I have devoted the first part of this book to a consideration of discoveries made in Africa, Asia, Australia and America, that none have been made in Europe during recent years. Far from it. Europe still remains the headquarters of all who endeavour to search into man's early history. During the past six years—since the autumn of 1924—many and important additions have been made to our knowledge of ancient Europeans. Nor have I any doubt as to the discovery which should first engage our attention. It is that made right in the heart of Germany, at Ehringsdorf, a village near Weimar, on September 21, 1925. The importance of this discovery lies in the fact that, until it was made, we had no certain knowledge of the kind of men who lived in Central Europe during the long temperate period which preceded the last great glaciation (Würm). We did know, from discoveries made in the caves of France, that when the last glaciation set in—the Würm glaciation—Western Europe was inhabited by men of the Neanderthal type, and that their culture was Mousterian (fig. 162, p. 464). The discovery of the Ehringsdorf skull assures us that the men who lived in Germany in the preceding temperate period, while they must be assigned to the Neanderthal type, yet differed from that type in many details of structure. Although Ehringsdorf man falls in the period usually assigned to the Acheulean industry, yet the hand axes, so characteristic of that industry, are not found with him. He fabricated a great variety of tools, yet most of them are more akin in type to those of the Mousterian culture than to the Acheulean of France. His industry is perhaps best described as pre-Mousterian. Ehringsdorf man was the contemporary of *Rhinoceros mercki* and of *Elephas antiquus*, both of which became extinct in Europe before the Würm glaciation set in.

Let us look at the site of this discovery. Several miles before reaching Weimar (fig. 102) the tortuous Ilm flows with a north-westerly trend, but after reaching that beautiful city—formerly the home of Goethe and now the capital of the Thuringian States—it bends in a north-easterly direction (fig. 102) and 18 miles farther on joins the Saale, which, in turn, joins the Elbe. For some miles above Weimar the Ilm flows between

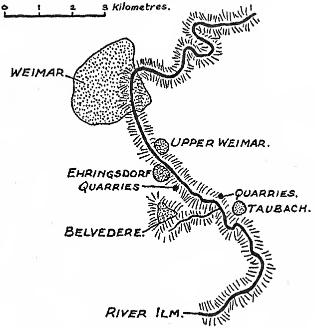


FIG. 102.—Sketch of the environs of Weimar.

steep high banks composed of travertine, that kind of limestone which has been deposited from springs richly charged with calcium carbonate. Quarries have been opened on both banks, for the travertine yields seams of good building stone. Those at the village of Taubach, which is situated on the right or eastern bank (fig. 102), 3 miles from Weimar, have long been famous for their fossiliferous stratum, which occurs at a depth of about 20 feet. From this stratum came the two human teeth described by Nehring in 1895.[1]

The village of Ehringsdorf is situated on the opposite

[1] See *Antiquity of Man*, vol. i, p. 191.

or western bank, midway between Taubach and Weimar. In the neighbourhood of Ehringsdorf there are five quarries, all situated quite close together, but only two of these need occupy our attention—Kämpfe's quarry and Fischer's quarry—which are adjacent—Fischer's being situated behind Kämpfe's, that is, farther away from the Ilm.[1] A visitor entering one of these quarries is struck by the height of the working face; it may be 60 feet or more in height—so thick is the deposit of travertine in this area. Strata are arranged horizontally, and as many as eighteen are distinguishable. Under and within various strata, especially those at deeper levels, have been found fragments of charcoal and other traces of ancient hearths; numerous stone implements, both in flint and in quartz, also occur, and also fossil bones of pleistocene animals. Only on three occasions have fossil human bones been brought to light. The first discovery was made in Kämpfe's quarry on May 8, 1914; the greater part of a lower jaw was uncovered at a depth of 39 feet.[2] The second discovery was made in the same quarry and at the same level, but 28 yards distant from the first on November 2, 1916. In this case a skeleton of a child, about ten years of age, represented by numerous fragments, was found. Fortunately, the greater part of the lower jaw was intact and provided important clues as to race. The second permanent molar had just come into place and still retained every detail of its cusp-pattern. The pattern is that which we find on unworn molar teeth of Neanderthal man. The third discovery was made on September 21, 1925, only three days before the International Palaeontological Society met in Weimar—a visit to the Ehringsdorf quarries being part of its programme. The discovery was made, not in Kämpfe's, but in Fischer's quarry, which lies behind Kämpfe's. A massive piece of rock had been

[1] See *Der Schaedelfund von Weimar-Ehringsdorf*, Fischer, Jena, 1928. The skull is fully described by Professor Dr. Franz Weidenreich of Heidelberg; the geology of the quarries by Dr. Fritz Wiegers of Berlin, and the Ehringsdorf Palaeolithic Industry by Dr. Erich Schuster of Weimar.

[2] The reader will find an account of this specimen in *Antiquity of Man*, vol. i, p. 192.

blasted from a deep stratum, one in which a thin layer of ashes, charcoal, broken and burnt bones, as well as implements, marked the site of an ancient hearth. A workman, on trimming the block, laid bare the vault of a human skull; in the fragment of the block which he had detached was another part of the skull. On the block was retained part of the hearth, so there can be no doubt as to the level at which the skull lay; it was 54 feet (16·7 m.) below the original surface of the quarry.[1] Although the level at which the Ehringsdorf skull was found in Fischer's quarry is 15 feet deeper—as measured from the surface soil—than that in which the lower jaw was found in Kämpfe's quarry, yet both lay in the same stratum and belong to the same period. The actual distance between the sites at which these two fossil representations of Ehringsdorf man were found was only 125 yards; the one quarry repeats the story told by the other.

The blocks of travertine in which the skull was embedded were removed to the Weimar Museum, where by exercise of great patience and skill Herr Lindig, Conservator of the Museum, succeeded in freeing all the fragments from the hard travertine rock in which they were embedded. Professor Weidenreich, to whom the reconstruction of the skull was entrusted, and of which he has given a full and lucid description,[2] watched the unveiling of the skull by Herr Lindig; it was clear to him that the skull had become embedded while lying on its left side; the skull, under the weight of the strata which accumulated over it, had become crushed and flattened. It was that of a young person, certainly under 25 years of age, for all the bones of the vault had parted at open sutures. Nevertheless, Professor Weidenreich succeeded in grouping the bones and fragments of the skull so as to obtain a close approximation to its original form. Only the vault and sides of the skull were found; the face and base were missing; no sign of any

[1] Dr. Wiegers gives the depth as 18·5 m.; the discrepancy is probably due to a difficulty in estimating the exact height of the soil which originally covered the quarry.

[2] See reference, p. 317.

bone of the body was seen. There can be no suspicion here of a regular burial; the vault and sides of a human skull had been carelessly thrown away in a spot where they became naturally entombed in limestone and thus preserved.

Professor Weidenreich was surprised to find, as he made a careful examination of the frontal bone, that there was clear evidence of five wounds, all of which had been inflicted when the bone was fresh, whether before, at or just after death cannot now be determined. Of these five wounds (see fig. 106, p. 328) one, upon the right side of the forehead, was caused by a blow from a blunt implement, delivered with such force that a rounded area of the bony wall was forced inwards and shivered—enough to produce immediate loss of consciousness. The other four wounds were such as might have been produced by a flint implement with a sharp edge; one blow, over the left orbit, caused a linear fracture to spread upwards to the vault; the other three, delivered over the right orbit, were vertical in direction; a piece of bone over the right orbit had been separated by these blows. The reader will remember that Miss Dorothy Garrod found human skull bones in the cave at Shukbah (p. 209) cut and broken in a similar way. There is also evidence of cannibalistic practices amongst the Neanderthal people of Krapina. We are therefore inclined to agree with Professor Weidenreich when he suggests that the skull found in the travertine of Fischer's quarry had been cast away by a party which had feasted on the brain contained within the skull—for there is a growing volume of evidence which convicts early man of a fondness for animal brains and perhaps also for human brains.

Our introduction to Ehringsdorf man has been of a somewhat unsavoury nature, and the reader may be willing to turn aside for a moment to more interesting problems concerning him: When did he live? How did his skull, his implements, his hearths, the refuse of his feasts become embedded in a limestone quarry? Clearly

the revelations which are being made of ancient man in the quarries of Ehringsdorf differ in nature and in extent from those which have come to us in the course of cave-exploration. Under and within this deposit of limestone has been preserved a camping ground of ancient man. What was the size and shape of the valley of the Ilm when Ehringsdorf man began to frequent it? What tempted him into it? When did he occupy this camping ground? How did all he left behind become consolidated and preserved in solid rock?

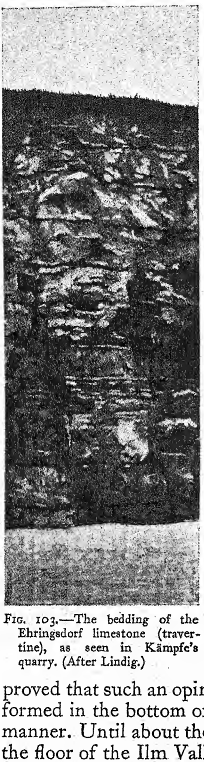


FIG. 103.—The bedding of the Ehringsdorf limestone (travertine), as seen in Kämpfe's quarry. (After Lindig.)

When writing in 1924 an account of the discoveries made at Taubach and Ehringsdorf, I accepted the opinion then usually held that in early pleistocene times the valley of the Ilm above Weimar had been the site of a lake and that the horizontal strata, exposed in the quarries (fig. 103), had been laid down on the bottom and shores of the lake. Palaeolithic hunters, it was supposed, had camped on the shores of the lake; what they left behind them became embedded as deposits accumulated and the level of the lake rose. Dr. Franz Wiegers[1] has proved that such an opinion is untenable: travertine is not formed in the bottom of a lake, but in a totally different manner. Until about the middle of the pleistocene period the floor of the Ilm Valley above Weimar was covered by

[1] See reference, p. 317.

grass lands which sloped gently down to the banks of the meandering Ilm. The sides of the valley were steep and less than a mile apart. The steep banks were formed by deposits of the triassic period, and were rich in lime. Water charged with lime salts in solution issued from springs at the base of the high banks and flowed in a myriad of streams and pools across marsh and meadow to reach the Ilm, coating with lime every leaf and stem which grew in the bed or bank of the rivulets. Such a well-watered valley would attract game, and hunters would follow the game. Between the rivulets must have been higher ground—suitable for camping—on which grew the willow, alder, birch, hazel, walnut, crab-apple and dog-rose, for leaves, stems and fruit of all of these are preserved in the travertine. Altogether an abundance of plants belonging to forty-one different species have been found in the Ehringsdorf quarries. Of game there was abundance; at first older forms of rhinoceros, elephant and horse prevailed; later the bison, aurochs, red deer, Irish deer and the elk came in abundance; altogether fossil remains of twenty-five species of mammals have been found. The Ilm Valley was in mid-pleistocene times a hunter's paradise.

Summer and winter, year after year, streams flowed across the meadows, coating their banks, filling their channels and gradually changing their courses, and always depositing their surcharge of lime on and under the green mantle which clothed the floor of the valley. Thus, inch by inch, the level of the floor of the valley was raised until a thickness of strata of 60 feet or more was attained. The deposit of travertine at Ehringsdorf extends backwards from the present bank of the Ilm for 500 yards; it continues along both banks for about a mile. The rate at which the travertine grew depended on many circumstances: on rainfall, on temperature, on rate of evaporation. Hence the strata of the quarries represent phases of climate. The deposition began in a temperate climate and ended in a cold one—one which brought the reindeer and other animals of the Arctic zone.

In Fig. 104 I have given a diagrammatic representation of the Ehringsdorf strata as seen in Kämpfe's quarry. The series begins below with a thick stratum of

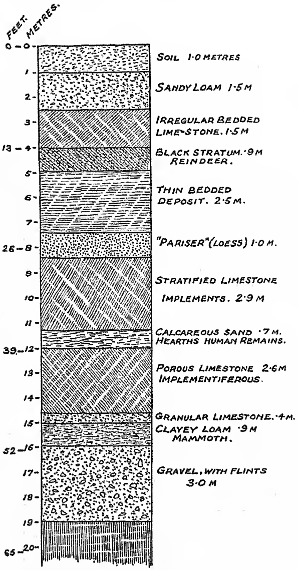


FIG. 104.—A diagrammatic section of the strata seen in Kämpfe's quarry. In this quarry the fossiliferous stratum—that in which human remains have been found—lies at a depth of 39 feet; in Fischer's quarry this stratum occurs at a greater depth—54 feet. (After Wiegers.)

coarse gravel—an old bed of the Ilm. Many of its ingredients are of glacial origin, showing that a glacial period had come and gone before the travertine had begun to form. Over the gravel comes a bed of loamy

clay, such as forms the substratum of meadows along the valley of the Thames and covers the old gravel bed of that river. Then above the loamy clay begin the limestone deposits, first a thin layer of granular texture, then a thick consolidated stratum, 8 feet in thickness. When this layer was being formed, man was frequenting the valley, for his implements occur in it. They are of the pre-Mousterian type. Then above this thick dense stratum comes a more porous deposit, apparently formed slowly and on a land surface which was a dwelling-place for palaeolithic hunters. In this stratum, which lies at a depth of 39 feet in Kämpfe's quarry, occur the hearths, human remains, broken bones of animals and implements. The fauna and flora indicate a temperate climate. Over the human stratum comes a dense one of stratified limestone, 9½ feet thick, apparently formed rapidly. Man still frequented the valley, for implements still occur of the same type as deeper down. Then follows a stratum which has been much discussed; it is known to the quarry-workers as "Pariser"—a porous stratum. It contains a high percentage of loam and sand and is regarded as the equivalent of the loess deposits of open valleys—a deposit which marks a phase of the last glacial epoch. The Mousterian floors lie under the loess. Therefore, above the Pariser we must infer we have to deal with deposits laid down in the later part of the last glacial age. The occurrence of the reindeer in these later deposits is in favour of this interpretation. Nevertheless, it is said that such implements as have been found in the uppermost strata do not differ from those of the deepest.

Now, the skull unearthed in Fischer's quarry comes from the human stratum which occurs in Kämpfe's quarry at a depth of 39 feet. When we take all the evidence into account—the fauna and flora of the lower travertine—the strata under the Pariser, the pre-Mousterian type of the implements and the succession of strata marking the onset of Arctic conditions—there cannot be a doubt that the fossil remains found at Ehrings-

dorf represent the people who lived in Germany in the long interglacial or temperate period which preceded the onset of the last or Würm glaciation. It is the period of Acheulean man, and the skull found in Fischer's quarry is the only certain representative we have of that period. It is therefore with particular interest we enter upon the description of Ehringsdorf man.

CHAPTER XXI

THE EHRINGSDORF SKULL. EARLY NEANDERTHAL MAN

In giving an account of the Ehringsdorf skull my task has been made easy by Professor Weidenreich's labours; he has investigated the skull thoroughly and described it in great detail. In fig. 105 a true profile of the skull is depicted. I have also added to it a drawing of the lower jaw found in Kämpfe's quarry in 1914 to ascertain how far it can be made to agree with the skull. Seeing that the lower jaw has been ascribed to a woman, and that Prcfessor Weidenreich is of opinion that the skull is probably also that of a woman,[1] there can be no harm in placing the two fossil fragments into juxtaposition, although found at sites 100 metres apart. The correspondence is near enough to make one feel confident, not that the skull and lower jaw are parts of the same individual, but that the various fossil fragments [2] found in the Ehringsdorf quarries represent the same race and that this race must be regarded as a variety of the Neanderthal species.

We are at once impressed by the dimensions of this ancient skull. Neanderthal examples are usually low-roofed, but in this instance the vault is lofty. In modern skulls of average size the highest part of the vault usually reaches the 100-mm. level shown in fig. 105, but in this case it rises 8 mm. above the 100-mm. level. The height is not due to the thickness of the cranial vault; the opposite is the case. The bones of the vault vary in thickness from 4 to 6 mm. as in most modern skulls, whereas the usual thickness in Neanderthal skulls is from 7 to 8 mm. The height of the vault is due to the massive size, an upward growth of the frontal and parietal lobes of the brain, particularly of those parts which are

[1] For author's opinion, see p. 338.

[2] A piece of parietal bone was found in Kämpfe's quarry in 1908. It was 10 mm. thick. This suggests that the thinness of the vault of the Ehringsdorf skull may be due to youth.

concerned in the reception of sensation from trunk and limbs, and in the control of voluntary movements. No matter what base line we select for measuring the height of the vault, we find that the Ehringsdorf skull exceeds other Neanderthal specimens in its loftiness. If we

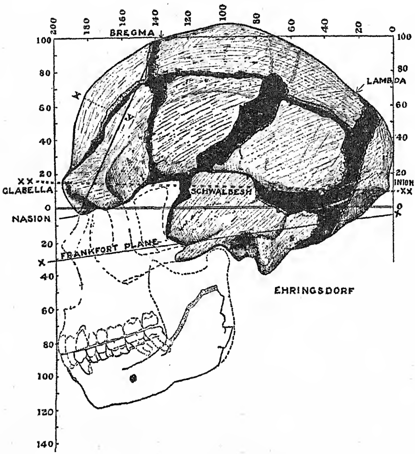


FIG. 105.—Profile of the Ehringsdorf skull. The missing parts of the face are represented by stippled lines. The lower jaw, attached to the skull, is that found in Kämpfe's quarry in 1914. The skull is oriented on the subcerebral plane, and placed within a framework 200 mm. long and rising 100 mm. above the subcerebral plane. The Frankfort and Schwalbe's (glabello-inial) planes are also indicated. (After Weidenreich.)

estimate the height from the glabello-inial base (Schwalbe's plane) it is 96 mm., if from the Frankfort plane it is 121 mm. The only Neanderthal skulls which approach it in these measurements are the specimens known as Spy II and the young man's skull from Le Moustier. Even in Spy II the vault rises only 87 mm. above Schwalbe's plane, 9 mm. less than in the Ehringsdorf

specimen; in Spy I and in the original Neanderthal skull the height of the vault is only 81 mm.—15 mm. less than in the Ehringsdorf specimen. We cannot doubt that this very early representative of the Neanderthal species had a large brain. We are surprised by its upward development as well as by its massive dimensions.

Neanderthal skulls are usually long, often attaining a maximum length of 200 mm., and not infrequently exceeding this amount. Hence I have placed the Ehringsdorf skull, as shown in fig. 105, within an oblong frame 200 mm. long; the skull falls 4 mm. short of the anterior limit, being 196 mm. long. This deficiency, however, is not due to lack of brain space, but to the fact that the anterior bony wall of the skull—as measured at the level of the glabella—falls short of what is usual in adult Neanderthal skulls. The thickness of the glabellar wall in the Ehringsdorf skull is 19 mm.—4 to 6 mm. less than is common in male skulls of the Neanderthal type. This deficiency may be due to the skull being that of an immature individual; the open condition of the sutures suggests that the skull is that of a young person, perhaps under 20 years of age, and that 4 or 5 mm. would have been added in the course of growth had the individual lived. However this may be, the fact remains that the brain chamber was 171 mm. long, the rest of the total length, 196 mm., being made up by the thickness of the frontal and occipital bony walls. Thus the brain space made up 87·7 per cent. of the total length, the bony walls 12·3 per cent. It is usual for the bony walls to make up 16 per cent. of the skull length in men of the Neanderthal type, whereas in men of the modern type 8 or 10 per cent. are common amounts. As a rule, we may regard skulls with thick bony walls and restricted brain space as being primitive in nature, and those with thin walls and expanded brain chambers as highly evolved. When we apply this criterion to the Ehringsdorf skull, we see that it is less primitive than most Neanderthal skulls, and yet it is the oldest representative of the Neanderthal type known to us so far.

To continue our general survey of the Ehringsdorf skull, let us examine it from above. In Fig. 106 it has been placed within a framework of lines which is 200 mm. long and 150 mm. wide. The skull is not quite symmetrical; its right half is wider than its left. Its greatest width is 145 mm.; the width is 74 per cent. of its length; it is, like most Neanderthal skulls, dolichocephalic. If,

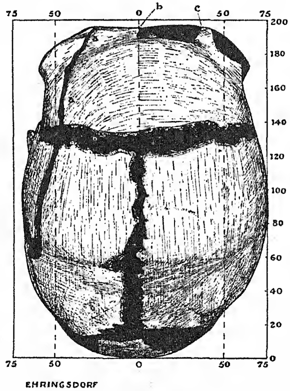


FIG. 106.—The Ehringsdorf skull, placed on the Frankfort plane and viewed from above (after Weidenreich). a, a, fissure caused by a blow over the left orbit. b, c, sites of incisions made by a sharp-edged stone tool.

however, we confine out attention to the length and breadth of the brain chamber, we find that the width proportion is greater. The brain chamber is 171 mm. long; it is 134·5 mm. wide, the width being 78 per cent. of the length. The dolichocephalism of Neanderthal skulls is exaggerated by the great thickness of their glabellar wall. We notice, too, in fig. 106, that the greatest width of the Ehringsdorf skull, as in modern skulls, lies well forwards, being situated at or near the trans-auricular

line, whereas in Neanderthal skulls—as is also the case in the skulls of anthropoid apes—it is usual for the widest part of the skull to be situated in the posterior third of the parietal bones, well behind the trans-auricular line. The reader will also obtain from fig. 106 an impression of the width and extent of the supra-orbital shelf. It is seen to be sharply differentiated from the vault of the skull.

We have seen that the Ehringsdorf skull is high-vaulted; some light is thrown on this character when we

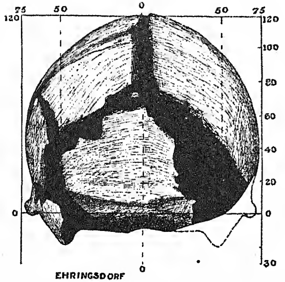


FIG. 107.—Occipital view of the Ehringsdorf skull. For the purpose of this drawing the skull was oriented on the Frankfort plane, represented by the line O, O. (After Weidenreich.)

examine the skull from behind, as in fig. 107. The skull is there oriented on the Frankfort plane O, O; the sides of the skull formed by the right and left parietal bones are seen to meet along the mid-line, the highest point of their ridge-like union being 121 mm. above the Frankfort plane. This is 7 to 10 mm. higher than is usual in the larger Neanderthal skulls. The outline of the Ehringsdorf skull, as viewed from behind, gives the impression that the side walls have been pressed together so that the vault appears ridged, like the roof of a house. In this it is quite unlike any representative Neanderthal specimen in which the vault is flat and has the appearance

of having been compressed from above downwards. The occipital view also reveals the imperfection of the fossil fragments out of which the original skull had to be reconstructed. The bases of the mastoid are only about 117 mm. apart. As the mastoid processes indicate the width of the neck, one would infer from the small bi-mastoid width that either the skull is that of an immature male or of an adult female. The large dimensions of the skull—length 196 mm., width 145 mm., auricular height 121 mm.—lead us to expect a large brain. When we apply to these dimensions a formula employed for determining the size of brain chamber in modern skulls,[1] we obtain a capacity of 1520 c.c. for the Ehringsdorf individual, even when 6 mm. has been deducted from the length measurement on account of the thickness of the glabellar wall. Nevertheless, Professor Weidenreich found that when he measured a cast taken from the interior of the skull, it displaced only 1450 c.c. of water. It is probable that the actual size of the brain lies between these two measurements and that the cranial capacity of the Ehringsdorf individual was about 1480 c.c., which is the mean for modern Englishmen. The brain, therefore, in point of size reached a modern standard, and certain of its characters indicate a high degree of specialization. Professor Weidenreich draws attention to the pronounced development of the third frontal convolution; the impression made by this part of the brain in the interior of the frontal bone is particularly well-marked. Part of the left sphenoid bone was also found; it contains the fossa in which lies the tip of the temporal lobe of the brain; the fossa shows that this part of the temporal lobe was narrow but deep. The occipital bone carries the impressions made by the hinder ends of the right and left occipital lobes of the brain. The left impression is much more extensive than the right, showing that the specialization of the left occipital lobe, which Professor Elliot Smith rightly associates with right-handedness, was already fully evolved. We know the tools which

[1] See *Antiquity of Man*, vol. ii, p. 596.

were shaped by Ehringsdorf man, and are not surprised to learn that he was, as most of us are, right-handed.

Certain features of the frontal and parietal bones deserve mention, because they help to emphasize the opinion we have formed concerning the high development of the brain in this particular representative of the Ehringsdorf race. The arch of the frontal bone, measured along the middle line from nasion to bregma (fig. 105) has a length of 135 mm. This measurement, although high, is not exceptional; in the original Neanderthal skull the frontal arch measures 133 mm.; in the large La Chapelle skull 135 mm. When the frontal arch is long, we expect by way of compensation a reduction in the length of the parietal bone. For instance, in the Neanderthal skull the parietal arch only measures 110 mm., in the La Chapelle skull 121 mm. In the Ehringsdorf skull the parietal arch is not reduced but long, namely 128 mm. The frontal bone of the Ehringsdorf skull is also remarkable in several other respects. It is exceptionally upright; the forehead, far from being low and receding, as is the rule in skulls of the Neanderthal type, is as vertical and as prominent as in most skulls of the modern type. The frontal bone is strongly arched. If we draw a line from nasion to bregma (fig. 105) to represent the chord of the arch (this chord, by the way, is 115 mm. long) and then measure the distance of the convexity of the arch from the chord (fig. 105 X, Y), we have a means of estimating the degree of frontal curvature. The height of the Ehringsdorf frontal arch, when thus measured, is 25 mm.—an amount which is reached only in skulls of the modern type and never approached in skulls of the Neanderthal type. For example, in the Galilee the frontal arch measures only 17 mm., yet the arch is relatively pronounced in this specimen.

Up to this point we have been considering the general characters of the Ehringsdorf skull; several of these lead us to associate it with the neanthropic (modern) type of skull rather than with the Neanderthal type. When, however, we turn our attention to those features which

mark off Neanderthal skulls from all varieties of the neanthropic type, we are left in no doubt as to racial nature of the Ehringsdorf people. The hall-marks of the Neanderthal species lie in three regions of the skull—in the forehead, in the region of the ear passage and in the occiput. We shall survey these three regions of the Ehringsdorf skull, taking the supra-orbital region first.

The supra-orbital ridges are moulded as in all Neanderthal skulls, to form a transverse bony shelf or torus which crosses the forehead above the orbits. In the Ehringsdorf skull it is remarkably wide, measuring 133 mm. from one extremity to the other. This is the largest measurement obtained in skulls of the Neanderthal type; it is 10 mm. more than is usual in the larger male skulls, and 20 mm. more than is common in primitive modern skulls. The ridges, however, are not thick in their vertical diameter; over the middle of the left orbit the bony shelf measures only 12 mm.—3 or 4 mm. less than is usual in Neanderthal skulls. We have seen that the shelf when measured from back to front in the glabellar region has a thickness of only 19 mm. These low measurements I regard as indications of the immaturity of the Ehringsdorf skull.[1] Just above the supra-orbital ridges the temporal lines ascend on the side of the forehead. These lines are remarkably far apart in Neanderthal skulls. In the Ehringsdorf skull their distance apart—the minimal width of the frontal—is 113 mm.; the skulls which most closely approach the Ehringsdorf in this character are the skulls known as Spy II and La Chapelle; in them the minimal frontal diameter measures 109 mm. The great distance apart of the temporal lines does not mean that the brain-containing part of the forehead was really wide, for when we measure the frontal bone at its widest we find that Neanderthal skulls are in nowise exceptional.

[1] The two frontal air sinuses were well developed. They extended outwards from the mid-line of the glabellar region for 37 mm., they had a vertical measurement of 22 mm. and an antero-posterior of 15 mm. Professor Weidenreich observed that the sphenoid sinus was continued into the root of the pterygoid process. This, which is an anthropoid character, was also the case in the Galilee skull (see p. 190).

For example, the maximum width of the frontal bone in the Ehringsdorf skull is 121 mm.—a measurement often met with in modern skulls in which the minimal frontal width may be only 96 or 98 mm. The maximal frontal width for Neanderthal skulls is remarkably constant, varying from 120 to 124 mm. The great width of the supra-orbital torus indicates great development of the muscles of mastication, an inference which gains support from the robust development of the Ehringsdorf mandible found in Kämpfe's quarry. The orbits were remarkably wide, the width, measured between the inner ends of the fronto-malar sutures, being 122 mm.—11 mm. more than in any other skull of the Neanderthal type. On the other hand, the interorbital septum (internal bi-angular width) measured 30 mm., which is not an uncommon width in either Neanderthal or modern skulls. Thus our study of the supra-orbital ridges reveals characters more primitive than are met with in other skulls of the Neanderthal type.

No bone of the skull reflects the cranial characteristics of Neanderthal man so clearly as the temporal, in which the ear passage (auditory meatus) is situated. In fig. 108 I have superimposed the outline of a left temporal bone of neanthropic man (stippled outline) upon the corresponding bone of a Neanderthal skull, the specimen found by M. Martin at La Quina, France.[1] In front of the ear passage is the zygomatic process; behind it the mastoid process. The zygomatic process of the Neanderthal skull is much stouter than that of the modern skull. In front of the ear is the articular fossa for the condyle of the lower jaw; this fossa is deep in neanthropic man (fig. 108, b); it is cut deeply into the root of the zygoma, so that the depth of the fossa reaches up almost to the level of the roof of the ear passage. In the Neanderthal skull, on the other hand, the fossa (fig. 108, B) is so shallow—so slightly is the zygoma excavated—that its deepest part lies level with or below the mid-point of the ear passage.[2]

[1] See *Antiquity of Man*, vol. i, p. 176.

[2] For further details concerning the temporo-mandibular joint, see *Antiquity of Man*, vol. ii, p. 650.

In front of the deep articular cavity in the neanthropic skull is a well-marked articular eminence (fig. 108, a), while in the Neanderthal skull this eminence is much less apparent (fig. 108, A). A reference to the drawing of the Ehringsdorf skull (fig. 105, p. 326) will convince the reader that in all its pre-auricular features it is typically neanderthaloid.

Behind the ear passage lies the mastoid process—a bony lever for giving attachment to muscles of the neck.

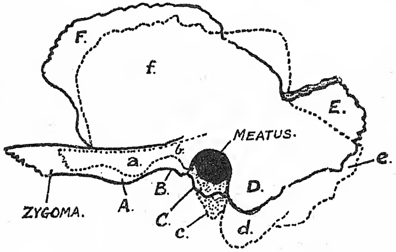


FIG. 108.—Outline of the left temporal bone of a Neanderthal skull (La Quina). On this, shown by a continuous outline, has been stippled the outline of the temporal bone of a modern skull. A, articular eminence for lower jaw on the root of the zygoma of the Neanderthal bone; a, corresponding eminence on the modern bone; B, the articular fossa for jaw in the Neanderthal bone; b, in modern bone. Further explanation in text.

The mastoid of neanthropic man (fig. 108, d) is not only longer than that of Neanderthal man (fig. 108, D), but it is also bent downwards and forwards, leading to a compression of the tympanic plate. In Neanderthal man this plate is approximately horizontal (fig. 108, C), whereas in neanthropic man it assumes an oblique—almost vertical—direction (fig. 108, c). The only way to make a satisfactory estimate of the length of the mastoid process is to measure the distance to which its apex descends below the level of the Frankfort plane, which corresponds to the upper border of the auditory meatus. In neanthropic skulls the length of the mastoid process measured in this

way varies from 25 mm. to 35 mm., whereas in Neanderthal skulls the measurement is much less, varying from 15 mm. to 25 mm. In the Ehringsdorf skull the mastoid length is 25 mm., thus falling on the lower limits of the neanthropic scale and exceeding the usual Neanderthal length. In this one point there is an approach to the neanthropic condition, but as regards to the rest of the mastoid element of the temporal bone—the mastoid plate of the temporal bone, indicated by E in fig. 108—the Ehringsdorf skull is altogether neanderthaloid. The mastoid plate in the neanthropic bone (e) is turned downwards, whereas that of the Neanderthal bone is directed in a more upward direction. The significance of this difference we shall note presently. Meantime it is enough to say that the Ehringsdorf skull manifests both in front and behind the auditory meatus all the features which are characteristic of Neanderthal skulls (fig. 105, p. 326).

In the occipital region of the Ehringsdorf skull all the typical Neanderthal characters are exhibited. Mention has been made of the upward and backward trend of the mastoid plate in Neanderthal skulls (fig. 108, E). This is due to the relatively high position occupied by the occipital bone in adult skulls of the Neanderthal type (fig. 114, p. 351). No matter whether we orient on the Frankfort or subcerebral plane, the inion, in a skull of Neanderthal man, rises high above that plane.[1] The nuchal area—the area to which the neck is attached—made up of mastoid and occipital components—is remarkably flat in Neanderthal skulls and is directed in a backward as well as in a downward direction (fig. 105). This is a primitive or anthropoid feature of Neanderthal skulls. At, and just before, puberty the male neck grows rapidly in thickness and strength; its area of attachment to the occipital bone expands; the circumference of expansion is marked by two wide waves of bone which encircle the occipital bone. In Neanderthal skulls these waves are wide and meet at the region of the inion, without welling up to form a sharply marked excrescence of bone—the external occi-

[1] See fig. 70, p. 201, vol. i, *Antiquity of Man.*

pital protuberance. The Ehringsdorf occiput has all of these markings of Neanderthal skulls.

We have seen that the vault of the Ehringsdorf skull is remarkably high in the fronto-parietal region, but as the vault is traced backwards to the region of the lamda (fig. 105, p. 326) it rapidly sinks. Thus the occipital region of the Ehringsdorf skull appears as if raised from below and compressed from above; it has the "bun-shape" so typical of Neanderthal skulls. This character is brought out by certain measurements which Professor Weidenreich gives of the occipital bone. The arch of this bone traced along the mid-line from lambda to opisthion, measures 117 mm., but the chord which joins these two points measures only 87 mm. From the difference between these two measurements the sharp curvature of the bone may be estimated. This may also be done in another way. The arch of the occipital bone—at its point most distant from its chord—is 32 mm. high. This measurement serves to show the sharp curvature of the occipital bone in the Ehringsdorf skull. In its occiput this skull shows all essential features of the Neanderthal race. A further point deserves mention here because it serves to bring out another primitive feature of the Ehringsdorf skull. In highly evolved modern skulls the inion, which marks the upper attachment of the neck to the skull, corresponds in level to the internal inion, which lies opposite the lower limits of the occipital lobes and above the upper limits of the cerebellum. In primitive skulls the area of the neck expands so that the external inion lies well above the level of the internal inion. In the Ehringsdorf skull the external inion lies 18 mm. above the internal inion.

Summary.—Let me bring this technical chapter to an end by giving my reasons for treating the discovery at Ehringsdorf at such length. My first reason is because of the antiquity of the Ehringsdorf people. The geological evidence is complete; it leaves us in no doubt that at last we have at our disposal the fossil remains of people who were living in Central Germany in the long temperate period which preceded the last glaciation—with the on-

set of which Neanderthal man became a cave-dweller in South Europe. The Ehringsdorf culture was pre-Mousterian or early Mousterian, yet the Ehringsdorf community seems to have flourished when the rest of Europe was Acheulean in a cultural sense. We have suspected that certain fossil fragments such as the Bury St. Edmunds skull[1] might represent people of the Acheulean culture, but the evidence was too slender to permit us to attach importance to such specimens. At Ehringsdorf there is no room for doubt; the human remains found there are older than any found on the continent of Europe, save the fossil human mandible found in the Mauer pit near Heidelberg.

Nor can there be any doubt as to the racial nature of the Ehringsdorf people. They represent a branch of *Homo neanderthalensis*. The analysis just made of the characters of the skull should leave the reader in no doubt as to the soundness of this conclusion. The characters of the two lower jaws found in former years strongly suggested that further discoveries would prove that the Ehringsdorf people were a branch of the Neanderthal species of man; the skull now found completes the evidence and also informs us that the tendency to large-brainedness, which so surprised us when we first came across it among the later Neanderthalians of France and Belgium, was already present in the people of Ehringsdorf. Indeed, it is not only the size, but also the characters of the brain of this Ehringsdorf individual which impress us. It was not lack of brains which caused Neanderthal man to perish in Europe. Nor are we surprised to note that in some minor points the Ehringsdorf skull makes a nearer approach to that of neanthropic man than do the later and more typical Neanderthal skulls. As we trace the ancestry of neanthropic man and of Neanderthal man backwards, we ought to find, if the theory of evolution is true, that there is a growing degree of resemblance between them, for we cannot doubt that both have been evolved from a common stem. Professor Weidenreich has

[1] See *Antiquity of Man*, vol. i, p. 239.

formed the opinion that Ehringsdorf man takes us towards the common parent, for he regards the Ehringsdorf individual as representing an intermediate type, one which shares Neanderthal and neanthropic characters.

We may regret that Professor Weidenreich had to work with fossil fragments which were defective and distorted. For my part I think we ought to count ourselves fortunate in that such ancient records of man in Europe should have been preserved at all. Certainly it was fortunate that such fragments should have fallen into the hands of an anatomist so skilled and capable as Professor Weidenreich undoubtedly is. I have checked his reconstruction at every point and come to the conclusion that we can accept the skull as depicted by him as giving a true reproduction of the original size and form. But as I have worked over the evidence, it has been forced in upon me that the skull is less mature than Professor Weidenreich thinks; it is probably that of a person about 18 years of age. I also think, in opposition to Professor Weidenreich, that it is probable that the skull is that of a young man rather than of an adult woman.

There remains one aspect of the Ehringsdorf discovery which the reader may have passed unnoted. The circumstances which made such a discovery possible are quite peculiar. The Piltdown remains and the Heidelberg jaw were preserved in river deposits; the fossil remains of Neanderthal man hitherto discovered have been preserved in cave deposits. At Ehringsdorf the life of an ancient community has been naturally entombed and preserved in and beneath a field of limestone. The only other site of discovery at all comparable to that at Ehringsdorf is the limestone quarry at Buxton, South Africa, in which was preserved the fossil skull of Australopithecus and of South African baboons which were the contemporaries of that anthropoid. If we are weighed by geological, palaeontological and archaeological evidence, we must conclude that in point of antiquity there is probably no great difference between the antiquity of Australopithecus and of Ehringsdorf man.

CHAPTER XXII

THE NEANDERTHAL CHILD. DISCOVERIES AT GIBRALTAR AND LA QUINA

In the preceding chapters we have been detained in the neighbourhood of Weimar to absorb the full significance of the discoveries relating to Neanderthal man made in the quarries at Ehringsdorf. We are now to move—still in search of light on these strange denizens of ancient Europe—into the extreme south-west of Europe. Alighting on the Rock of Gibraltar, some 1300 miles from Ehringsdorf as the crow flies, we have left the colder north and entered the Mediterranean zone, which at all times has enjoyed a milder climate than has Central Germany. The recent discovery made at Gibraltar differs from that made at Ehringsdorf in many respects. The Ehringsdorf skull came to light in the course of quarrying operations; Gibraltar skull No. 2 was found as the result of a special archaeological search. The limestone or travertine at Ehringsdorf in which human remains were found was laid down during the pleistocene period; the massive outcrop of limestone which forms the Rock of Gibraltar was formed during the jurassic period, long before the heyday of mammals. It would be useless to look in the Rock itself for any trace of human life; but in the jurassic limestone of the Rock numerous caves, shelters and fissures have formed; it is in the breccia, stalagmite and other deposits of these caves and shelters that traces of pleistocene life have been preserved. The skull found at Ehringsdorf represents an early phase of Mousterian man; that found by Miss Garrod at Gibraltar represents a late phase. The skull found at Ehringsdorf gives us the characters of a young individual; that found at Gibraltar tells us what the Neanderthal child looked like. Ehringsdorf has given us one of the latest finds in Europe, but it was Gibraltar which gave us our first Neanderthal skull. The skull known as Gibraltar I was found in Forbes quarry, situated at the base of the

northern face of the Rock, so long ago as 1848, although it was not until 1908, when Professor Sollas published his classical description, that its true nature was fully appreciated.[1]

As the reader knows, the northern end of the Rock is joined to the Spanish mainland by a flat belt or tongue of land. In 1917, when the Mediterranean was still a dangerous sea for ships, the Abbé Breuil, in the course of an official visit to Gibraltar, took a walk along the flats which skirt the northern face of the Rock. He knew very well that such an aspect could never offer the sunny rock-shelters beloved by ancient man, for here the Rock towers upwards to a height of over 1300 feet, throwing its base into shadow for the greater part of each day. Nevertheless, he kept his experienced eye open, and presently, not far from the eastern corner and just opposite the Devil's Tower (fig. 109), detected the signs of which he was in search. Less than 400 paces towards the west took him to the site of Forbes quarry, where the first Gibraltar skull came to light (fig. 109).

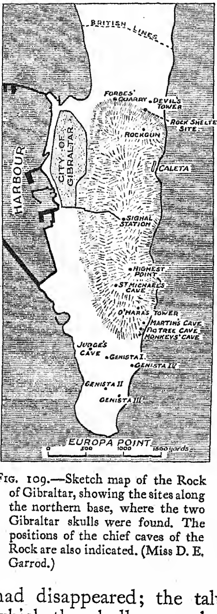


FIG. 109.—Sketch map of the Rock of Gibraltar, showing the sites along the northern base, where the two Gibraltar skulls were found. The positions of the chief caves of the Rock are also indicated. (Miss D. E. Garrod.)

He found that Forbes quarry had disappeared; the talus—the brecciated deposit in which the skull was embedded—had been quarried and carted away to serve the needs of town and harbour. Clearly if another palaeolithic site could be discovered

[1] For references concerning the original Gibraltar skull (Gibraltar I), see *Antiquity of Man*, vol. i, p. 180.

along the northern face, much light might be thrown on missing parts of the history of the original Gibraltar skull.

In 1919, the war being over, the Abbé Breuil returned to the Rock and verified his suspicions; he found definite evidence that the rock-shelter—let us call it the Tower shelter—had been occupied by man during middle palaeolithic times. The excavation of such a rock-shelter was a formidable undertaking; at the Abbé's suggestion it was entrusted to Miss Dorothy Garrod, who had worked with him in the field and had also studied anthropology in the University of Oxford. Receiving financial assistance from the Percy Sladen Fund, Miss Garrod sailed for Gibraltar in November 1925 and on her arrival set to work at the Tower shelter. The shelter was filled by natural deposits right to the top; it was really a narrow fissure near the base of the cliff; it was only 4 feet wide, but 40 feet in height. The fissure or shelter extended backwards into the rock for a distance of 13 feet. The floor of the shelter was continued forwards by a ledge or terrace about 40 feet in width. The deposits in the cave extended outwards on the terrace. It is also important to note that the floor of the cave was situated about 30 feet above sea-level, and still more important is it to note that Miss Garrod found the terrace to rest on an old sea beach, showing that at one time Gibraltar had been an island and that the waters of the Mediterranean had lapped against the base of the north face of the Rock.

Miss Garrod and her labourers toiled at the shelter through the winter 1925–26, until the heat of summer brought the first season's work to an end. She returned and completed the excavation in the winter 1926–27.[1] A summary of her exploration is shown in fig. 110; the figure represents a section of the cave from back to front,

[1] A complete account of Miss Garrod's work at Gibraltar will be found in the *Journ. Roy. Anthrop. Institute*, 1928, vol. 58, p. 33. In the final publication of her results she was assisted by Dr. L. H. D. Buxton, Professor G. Elliot Smith, F.R.S., Miss Dorothy Bate, Mr. R. C. Spiller, Mr. M. A. C. Hinton and Mr. Paul Fisher. The completed account is also published by the Institute as an *Occasional Paper* (1928).

and gives the reader at a glance the results obtained by two seasons of toil. The total thickness of deposits on the floor of the shelter was 27 feet, and they were divisible into six layers or strata. The uppermost and latest was made up of fine sand, having a depth of about 12 feet; then followed a dense limestone stratum, a travertine or tufa, laid down from percolating waters charged with lime salts. This stratum varied in thickness from 4 to 6 feet. Then followed a second stratum of fine sand,

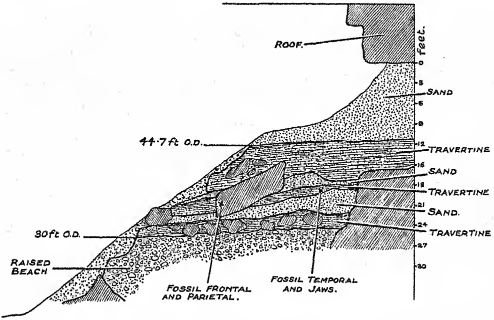


FIG. 110.—Section of the Devil's Tower rock-shelter, showing the strata and situations at which the parts of a child's skull were found. The section passes from the cliff forwards across the terrace. Explanation in the text.

succeeded by a second stratum of limestone tufa. Both of these strata—the third and fourth—were thin, amounting together only to about 3 feet, but from our point of view were of outstanding importance, because it was the second limestone stratum which contained the fossilized fragments of a child's skull (fig. 110). Then followed a third layer of sand; under it a third calcareous stratum. Great blocks of limestone had become detached and fallen from the face of the cliff at various times, and were embedded in all the deeper strata—particularly the deepest of all—the third or deepest stratum of travertine.

The last-named stratum rested on the raised beach (fig. 110).

Miss Garrod found definite evidence that men had been living in the Tower shelter during the deposition of all six strata. Every one of them yielded quartzite and bone implements fashioned by man; in the deepest and oldest stratum, as in the most superficial and latest, the implements were worked in the same style—the style which characterizes the final phases of the Mousterian culture—the culture of Neanderthal man. Every stratum had traces of hearths and of the residue of feasts. The fauna did not change; the animals represented in the deepest stratum were also present in the uppermost. From the fossil remains collected by Miss Garrod, Miss Bate succeeded in identifying 21 species of mammals and 33 species of birds. The fauna included the brown bear, wolf, red deer, seal and rabbit; the great auk also frequented the Rock then. The fauna is in keeping with the culture; it is a late pleistocene fauna.

Before inquiring into the nature of the human remains found in the deposits of the Tower shelter, let us see how far it is possible for us to assign a date to the period of its occupation. As the human deposits rest on the old sea beach, the date of occupation is clearly subsequent to the formation of that beach. Now the beach in question has been detected at many points along the shores of the Mediterranean; it was formed when the waters of the Mediterranean stood about 50 feet above their present level—or the surrounding lands about 50 feet lower than they now do. This beach, often named the Monastirian by geologists, was apparently formed during the long temperate period which preceded the last glacial epoch—the period to which Ehringsdorf man has been assigned. Now the deposits which filled the Grotte du Prince, near Mentone—900 miles from Gibraltar—also rested on the 50-foot beach. In the deepest stratum of that cave M. Boule found clear evidence of the Mousterian culture and fossil remains of the hippopotamus and of the older rhinoceros—the one found at Ehringsdorf—

R. mercki. In the floor of a cave in Malta, Ghar-Dalam, there is a rolled bone breccia which appears also to represent the 50-foot beach.[1] In the red cave earth, above the bone breccia, were found two molar teeth of Neanderthal man and the remains of a fauna comparable to that recovered by Miss Garrod at Gibraltar. Thus we have evidence at three points round the Mediterranean—Gibraltar, Mentone and Malta—that people practising the Mousterian culture, and therefore probably of the Neanderthal species, took up their habitation some time after the 50-foot beach was formed. The Mousterian culture has also been found along the African shores of the Mediterranean; the Neanderthal type has been found in Palestine at the eastern end of the Mediterranean. There is thus presumptive evidence that at one period the shores of the Mediterranean were inhabited by people of the Neanderthal or Gibraltar type. Thus the discoveries made by Miss Garrod have probably more than a local significance; we may look at the mode of life preserved in the rock-shelter at Gibraltar as representative of the manner in which men lived along the shores of the Mediterranean at a remote date.

How remote is that date? Academic geologists condemn all attempts to estimate remoteness of events in terms of years. In this I think they are mistaken, for we can never hope to attain to the truth concerning any matter until we have made a provisional guess to serve us as a working theory. We have to make our pleistocene calendar sufficiently ample to cover the events of that period. The provisional time chart which serves my purpose is shown in fig. 162 (p. 464). Therein the reader will see that I regard the Mousterian culture as beginning about 40,000 years ago and coming to an end about 20,000 years later. The culture in the Tower shelter belongs to the latter part of this period, whereas I suppose the Ehringsdorf culture to have been pre-Mousterian and therefore more than 40,000 years old. Thus I am supposing that the child whose skull I am about to describe

[1] See *Antiquity of Man*, vol. i, p. 346,

lived in the Rock some 25,000 years ago. Subsequent discoveries are more likely to increase than decrease my measure of antiquity.

Miss Garrod found five parts of a child's skull. Two of these—the frontal bone and left parietal—were discovered at the end of the first season's work in the travertine of the fourth stratum under a large block of fallen rock (see fig. 110); the three other parts—the right temporal bone, an imperfect upper jaw of the right side and a lower jaw, the right half of which was almost complete—were found during the second season in the same stratum of travertine, but in the mouth of the cave and not out on the terrace as were the fronto-parietal parts. No other human bone was found; only these five parts of a child's skull. Miss Garrod thinks the skull must have been placed originally where the jaws and temporal bone were found and that somehow the frontal and parietal bones became displaced and carried some 18 feet outwards on the terrace. We have here the same puzzling problem as in the Robbers' cave in Galilee. In both instances only part of a skull—a Neanderthal skull—was discovered after the most minute search.

Having completed her exploration of the Tower shelter, Miss Garrod carried her collections home to Oxford for investigation. The difficult task of extracting the fragments of the child's skull from the dense, rock-like travertine was undertaken by Dr. L. H. Dudley Buxton; it was he, too, who examined, compared and described the various parts found. My facts are drawn from his text,[1] but the drawings reproduced here have been made from casts of the bones which Professor Arthur Thomson of Oxford presented to the Museum of the Royal College of Surgeons. Hitherto, with the exception of the La Quina child, our conception of Neanderthal man has been based on the fossil bones of adult individuals. In unravelling the plan of human evolution, we can learn more from the transitory stages of childhood than from the stable condition reached by the

[1] See reference on p. 341.

adult. Hence the importance of the child's skull known as Gibraltar II.

When the fronto-parietal part of the skull was shown to me at the end of Miss Garrod's first season, I adjudged the child to have been about 12 years at the time of death. The characters seemed to me to resemble those reached by a modern boy in his twelfth year. The discovery of the jaws in the second season's work proved that I had greatly over-estimated the age of the Gibraltar child. Apparently Neanderthal children assumed the appearances of maturity at an earlier age than modern children. That the jaws belong to the same skull as the fronto-parietal bones there can be no doubt; the condition of the teeth proved that the child was not more than 6 years old, for all the teeth in use were of the milk set. The first permanent molar teeth, which in modern children come into use early in the seventh year, were still uncut. It is very probable that teeth erupted somewhat earlier in Neanderthal than in modern children. The Gibraltar child was therefore about 5 years of age. For this age it had a head and brain of truly remarkable size.

How large-headed the Gibraltar child was is made evident in fig. 111. There I have superimposed on the La Chapelle skull—the most capacious Neanderthal skull known—the various parts of the Gibraltar child's skull. The brain chamber of the La Chapelle man was 1625 c.c., nearly 150 c.c. more than in the average European man of to-day. The parietal bone of the child's skull is almost as large as that of the adult man (fig. 111). The frontal bone, although as high as the man's, shows certain significant differences. The child's skull is as upright as in a modern adolescent, but much less so than in a modern child 5 years of age. In the Gibraltar child the supra-orbital ridges characteristic of Neanderthal man have already begun to form; corresponding outgrowths do not appear in a modern child until a later age. We may feel assured that had this Gibraltar boy lived, for we can hardly doubt his sex, his forehead would have

assumed the obliquity and his supra-orbital ridges the prominence seen in the La Chapelle skull. Thereby 18mm. would have been added to the length of the boy's skull without materially increasing his brain space.

On the other hand, the temporal bone of the Gibraltar child falls far short of the La Chapelle bone. Particularly is this the case as regards the parts which form the joint

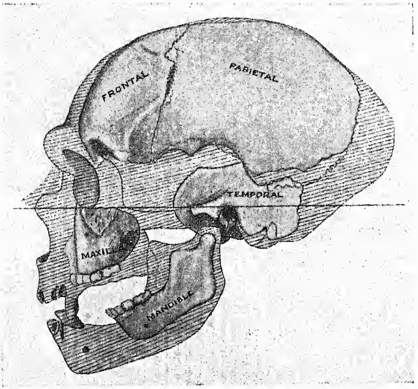


FIG. 111.—The parts of the Gibraltar child's skull superimposed on the profile of the skull of the man of La Chapelle.

for the lower jaw. But it is also true of the temporal plate which enters into the formation of the side wall of the skull. When, however, we come to compare the size of jaws, we see that those of the child are miniatures of those of the adult. Our comparison of the skull of this 5-year-old boy with that of a big-headed man of the same race shows us that the resemblances between Neanderthal and neanthropic man are greater in childhood than in maturity, and yet, as we shall see, all the hall-marks of the Neanderthal race are to be recognized

in the skull bones of the child. Our comparison also emphasizes the fact that Neanderthal man and modern man were alike in this respect, namely that the bones concerned in containing the brain reached nearly their full size in childhood, while the jaws, orbits, supra-orbital ridges, indeed, all the bones which make the face, still remained small and immature. Nevertheless, the jaws of the Gibraltar child are larger than those of a modern child of a corresponding age. This is illustrated in fig. 112, where the lower jaw of the Gibraltar child is super-

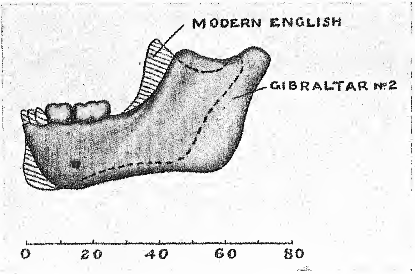


FIG. 112.—Lower jaw of a modern child, aged 5 years, superimposed on the lower jaw of the Gibraltar child.

imposed on that of a modern child of a corresponding age.

Let us now examine the cranial characters of this remarkable child. In fig. 113 a profile of the reconstructed skull is reproduced. The skull has been set on the Frankfort plane and placed within a frame of lines, 200 mm. long and 115 mm. high. The dimensions of the missing occipital bone can be inferred with a fair degree of accuracy. As thus reconstructed the skull is 184 mm. long, an uncommon measurement for any child aged 5. The width is also remarkable, 150 mm.; the width is over 81 per cent. of the length. In the original Gibraltar skull

—probably that of a woman—the length is 192 mm., the width 144 mm., this being 75 per cent. of the length. At first sight it may seem that the difference between the proportional widths points to a racial difference between the woman and the child. Had the child lived, its skull, by the addition of the supra-orbital ridges, would have increased much more in length than in width, and the

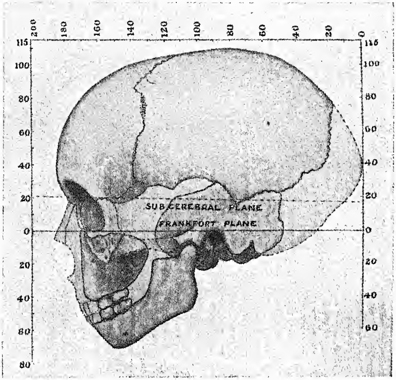


FIG. 113.—Reconstruction of the skull of the Gibraltar child. The parts found are shaded. The skull is set upon the Frankfort plane (O, O); the subcerebral plane is also indicated.

apparent difference would thus have been diminished. That in both boy and woman there was a tendency to a high cephalic index—as in the anthropoid apes—is seen when we compare the measurements of their brain chambers. That of the boy I infer to have had a length of about 172 mm.; this has to be compared with 166 mm. in the woman's skull; the width of brain chamber in the boy was about 142 mm., in the woman 134 mm. The width of brain or of brain chamber in the boy was over 82 per cent. of its length, while in the woman it was over

80 per cent. While the length and breadth—especially the latter measurement—are relatively large, the third measurement, the height of vault, is low, as is to be expected in skulls of the Neanderthal type. The vault of the child's skull rises 108 mm. above the Frankfort plane (fig. 113); the height of vault in the woman's skull is only 100 mm.; in the La Chapelle skull it is 114 mm. If we take our vault measurement from the subcerebral plane, we find the heights in these three skulls to be: in the woman's 88 mm., in the boy's 90 mm., in the man's 98 mm. The height of the boy's skull—as in all Neanderthal skulls—is low in comparison with its length and breadth. If we apply to these measurements of the boy's skull a formula for estimating the size of the brain, we obtain a volume of 1400 c.c. Now in the fifth year the brain of an average modern European boy has reached about 82 per cent. of its mature size. If we suppose that brain growth proceeded in Neanderthal children at the same rate as in modern children, then we may infer that 250 c.c. would have been added to the capacity of the Gibraltar child, the final size of brain being 1650 c.c.—25 c.c. more than in the La Chapelle man and 450 c.c. more than in the Gibraltar woman.

The discovery of this big-headed Neanderthal boy is of exceptional interest; amongst modern peoples, especially those which represent the bigger-brained races, we find a wide range in size of brain. The range amongst Neanderthal people seems to have been equally great. It is remarkable, too, that the two skulls found at Gibraltar give us the lowest and also—if our inference is right—the highest cranial capacities for Neanderthal man.

We know that the frontal lobes of the boy's brain were of ample dimensions. The minimal width of his forehead was 102 mm., the same as in the woman, but 7 mm. less than in the La Chapelle skull. His maximum frontal width, 125 mm., was slightly greater than that of La Chapelle man. A cast taken from the interior of the fronto-parietal fragment shows the convolutionary markings of the frontal lobes. The brain cast has been

described and its convolutionary markings have been discussed by Professor Elliot Smith.[1] He rightly ascribes a "high development to the pre-frontal areas".

The Gibraltar boy's skull manifests, as I have already mentioned, all the hall-marks of his species. His Neanderthal characteristics are best brought out by super-

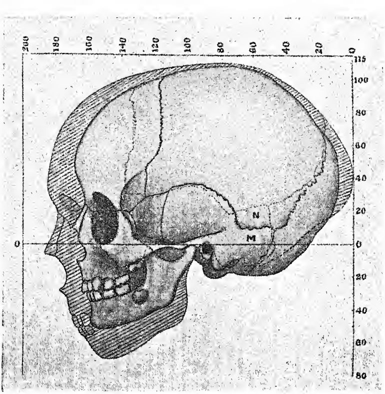


FIG. 114.—The skull of a modern child superimposed on that of the Gibraltar boy. The skull chosen for comparison is of moderate size, whereas the skull of the Gibraltar boy is exceptional in its dimensions. N, mastoid plate of Neanderthal child's skull; M, mastoid plate of modern child's skull. The Gibraltar specimen is indicated by parallel lines of shading.

imposing on his skull that of a modern child about the same age—5 years (fig. 114). The comparison made in fig. 114 is not quite fair; the dimensions of the Gibraltar skull are exceptional, whereas those of the modern skull chosen for comparison are rather less than are usual in an English boy of 5. Although the English skull falls far short of the Neanderthal boy's in length, yet its height of vault is almost as great. We see here that the skull of the

[1] See reference given on p. 341.

modern child provides brain space by expanding upwards, while the length measurements, particularly those of the base, remain restricted. The jaws and facial parts of the Neanderthal boy's face are larger and stronger than those of the modern boy. The forehead of the modern child bulges forwards in its upper part; as puberty is reached, great changes are usually effected in the modern boy's forehead. The prominence of the upper frontal disappears; the lower forehead and root of the nose grow forward, so that a forehead which had been upright in childhood may become receding and low as adult years are reached. These frontal changes have proceeded farther in the Gibraltar boy than in the modern child (fig. 114).

When discussing the characters of the Ehringsdorf skull, attention was drawn to the manner in which the Neanderthal temporal bone differs from the modern (fig. 108, p. 334). In Fig. 114 these differences are very apparent. In the course of development of the modern child's skull the mastoid plate of the temporal bone (fig. 114, M) has assumed a much lower position than the corresponding part of the temporal bone of the Gibraltar child (fig. 114, N). The superimposition of the two skulls brings out very clearly that the post-auricular part of the modern skull has undergone a growth movement of a rotatory kind, one which has carried the mastoid and occipital regions downwards and also forwards. Hence the low position of the cerebellar part of the occipital bone in the modern skull and its high position in the Neanderthal child. The same movement carries the mastoid of the modern skull forward and brings about the oblique, almost vertical position of the tympanic plate. The tympanic plate is a functional part of the masticatory system; hence in the Neanderthal child this plate, as well as the jaws, has attained a more pronounced development than in the skull of the modern child. Nor can there be any doubt as to the significance we are to attach to the greater flexure of the post-auricular part of the modern skull; it represents a later specialization, whereas the

Neanderthal child preserves in its occipital form a condition more akin to that seen in anthropoid skulls.[1]

Before bringing this chapter to an end there are several reasons which induce us to again visit the scene of Dr. Henri Martin's discoveries at La Quina in the Department of Charente (fig. 115). At La Quina, as at Gibraltar, two skulls have been discovered. At both places one skull is attributed to a woman, while the other is regarded as that of a child. The La Quina skulls lay in deposits

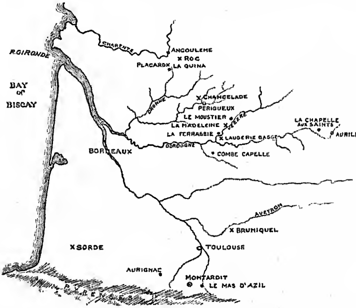


FIG. 115.—Sketch map, showing the sites in Southern France at which discoveries of palaeolithic man have been made.

assigned to the upper or later Mousterian culture. The Gibraltar child's skull was discovered in deposits assigned to the same cultural horizon, and I presume that the adult Gibraltar skull is attributable to the same level. The La Quina woman and child, although they lived 750 miles distant from the Gibraltar pair, may have been their contemporaries. Yet in point of head shape the two pairs differed greatly. The La Quina woman had a long and narrow skull with a vault of moderate height. Its length was 203 mm., width 138 mm., vault height 111 mm. The

[1] The beginning of this movement is apparent in the skull of Sinanthropus (see p. 288).

width of the skull was only 68 per cent. of its length.[1] The child's skull—I think we may speak of it as a girl's—has the same general form. Its width (132 mm.) is 77 per cent. of the length (171 mm.). The low index of the woman, however, is due not to the absolute narrowness of her skull, but to the great addition to its length by the growth of her massive supra-orbital torus. When we confine our attention to the dimensions of the brain chamber, we see that in her youth the woman did not differ so greatly from the child; the width of her cranial cavity was 74 per cent. of its length; in the child the width was 78 per cent. of the length. Nevertheless, it is apparent that the head tended to be wider and lower in the Gibraltar people than in the local population of La Quina. We seem to have at La Quina and Gibraltar evidence of the production of local breeds. As regards height of vault, that of the La Quina woman is 111 mm. above the Frankfort plane—11 mm. more than in the Gibraltar woman, while that of the La Quina child is 102 mm.—6 mm. less than in the boy's skull.

In fig. 116 a profile of the skull of the La Quina child is reproduced; an outline of the vault and face of the skull of the Gibraltar child has been superimposed, both having been oriented on the Frankfort plane, with ear placed over ear. The Gibraltar outline overtops that of the La Quina child; Dr. Anthony estimates the brain volume of the latter at 1100 c.c.—300 c.c. below my estimate for the Gibraltar boy. Yet the condition of the teeth points to the La Quina child as the older; its first permanent molars are in use and its upper central incisors are in process of eruption, a stage reached by modern children usually in the eighth year. The La Quina girl is 3 years older

[1] The reader will find an introduction to Dr. Martin's discoveries at p. 176, vol. i of *Antiquity of Man*. Dr. G. M. Morant has examined and measured all available Neanderthal skulls and published his results in a valuable monograph "Studies of Palaeolithic Man", *Annals of Eugenics*, 1927, vol. 2, pp 318–381, with 12 plates. Dr. Martin has published two monographs—one on the woman's skull, *L'Homme fossile de la Quina*, Paris. 1923; *L'Enfant fossile de la Quina*, Paris, 1926. Dr. R. Anthony has given an account of the endocranial cast (brain cast) of the child's skull: *Bull. de l'Acad. Med.*, Paris, 1923. vol. 90, p. 330.

than the Gibraltar boy, yet the upper and hinder regions of his skull far out-distance hers. When, however, we compare the degree of correspondence of the frontal and facial regions, we find evidence of the greater maturity of the La Quina child. Its supra-orbital, nasal and maxillary regions project in front of the corresponding parts of the skull of the Gibraltar child. In the mastoid and occipital

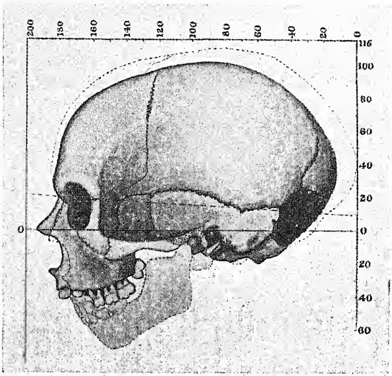


FIG. 116.—Profile of the skull of the La Quina child, based on data given by Dr. G. M. Morant. A stippled outline of the vault and face of the skull of Gibraltar child are superimposed.

regions we find in both the same Neanderthal characteristics.

In the adult Gibraltar skull are to be seen, better than in any other specimen, three noteworthy features of the Neanderthal face.[1] These are (1) the long, spatulate development of the nasal bones; (2) the sharp bony margin which forms the lower border or sill of the nasal opening, an exceptional specialization; (3) the forward projection of the nasal spine, which bespeaks a pronounced

[1] See *Antiquity of Man*, vol. i, fig. 71, p. 201.

development of the cartilaginous part of the external nose. These three features are recognizable in the profile of the La Quina child (fig. 116). Its nasal bones are 28 mm. long—10 mm. more than we expect to see in a modern child of the same age.

Studies of the skulls of children are important because they reveal to us the processes of growth. Such processes are concerned in giving to a skull its adult dimensions and final form. The forces or conditions which bring about the evolution of racial types must act by modifying the processes of growth. Now our studies of the skulls of these two children from Gibraltar and from La Quina have shown us that in the regions of the forehead, and also I think of the occiput, the Neanderthal and neanthropic differed much less in early childhood than in adult years. If we could arrest growth so that the Neanderthal child when it became adult retained its frontal and occipital characters, the differences between the Neanderthal and neanthropic types would disappear to a considerable extent. Yet even if the adult Neanderthal skull retained the upright forehead and fuller occiput of infancy, the essential characteristics of the race would still remain and be detectable in the mastoid, ear passage, glenoid cavity, cheek bones, orbits, jaws and teeth, showing that the differences between the Neanderthal and neanthropic species of mankind are deep, real and probably of very ancient date. We see, too, how variable was the brain of Neanderthal children in point of size, and we may infer that there were equally great differences in their mental ability. Further, we see that the Neanderthal brain must have undergone, during the growth of every individual, changes in form, consequent on the changes in skull shape. We must be careful, therefore, not to attribute too much significance to the general shape of the brain when interpreting the functional significance of brain casts. It is the number, size and arrangement of the convolutionary markings which must guide us in assessing mental status from a study of brain casts.

CHAPTER XXIII

NEANDERTHAL MAN IN SPAIN, ITALY AND RUSSIA

It would be strange, indeed, if the Neanderthal people never obtained a footing in Spain. They were the sole occupants of France over a long space of time. They obtained, as we have just seen, a settlement in the Rock of Gibraltar. Yet so far as I can learn, only one authentic fossil fragment of the ancient race has been found in the whole of Spain. It is the greater part of a lower jaw, found so long ago as 1887, but it is only in recent years that its true nature has been recognized.[1] The jaw was found near Bañolas, a small town situated in the north-eastern corner of Spain, some 20 miles inland from the Mediterranean, and about the same distance from the neighbouring French frontier. Near Bañolas is a deposit of limestone—a travertine—quarried for commercial purposes. In April 1887 the quarrymen, while working a stratum about 15 feet beneath the surface soil, discovered the jaw, fast embedded in travertine. Some of the original rock still clings to the specimen. No other fossil bone was noticed either of man or of beast. Nor were any implements recovered in the quarry. In this case the fossil fragment carries in itself the evidence of its authenticity.

Fortunately for my purpose true profile drawings of both sides of the Bañolas mandible have been made and published in their natural size. The two sides do not quite agree; asymmetry is a common feature in human mandibles, both ancient and modern. In fig. 117 I have given a composite outline, combining the features of both right and left halves. A mandible possessing such measure-

[1] I am indebted for my knowledge of this important specimen to a paper which Professor Sergio Sergi of Rome published in the *Revisita di Antropologia*, 1918, vol 22, p. 3—"La Mandibola di Bañolas". Professor Sergi drew his information concerning this specimen from original observations published by Manuel Cazarro, E. Harle and particularly from the communication of Hernandez Pacheco and Hugo Obermaier. References to these papers are given in Professor Sergi's article. This fossil mandible is preserved in the collection of Father Alsius of Bañolas. See Hrdlička's *Skeletal Remains of Early Man*, 1930.

ments, proportions and characters has never been found in human beings of the modern type, only in members of the Neanderthal species. Over the outline of the Bañolas jaw I have superimposed that of the massive La Chapelle mandible. So far as concerns the ascending rami, to which the muscles of mastication are attached, there is a close degree of correspondence between the French and Spanish specimens. When, however, we compare the regions of the chin, we see that the Spanish specimen is the less simian; there is to be recognized on the lower part of its symphysis a distinct rudiment of the bony eminence

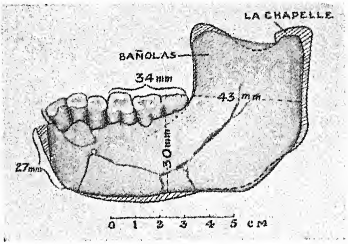


Fig. 117.—Profile of the Bañolas mandible, with outline of La Chapelle mandible superimposed.

we call the chin. The symphysis of the Bañolas mandible is remarkably shallow, only 27 mm., whereas at the second molar tooth the horizontal ramus has a greater depth, namely 30 mm. In the chin region and also in the mandible there is a remarkable degree of correspondence between the Bañolas and Ehringsdorf mandibles, leading one to suspect that this ancient Spaniard represents an early type of Neanderthal man. The teeth, too, although worn, are massive in size, the total molar length being 34 mm., while the total length of the dental palate was 60 mm. Unfortunately we do not know the width of the dental palate in the Bañolas specimen, but a statement is made that it was narrow, as is the case in the Ehringsdorf

jaw. Thus Spain, like France, Belgium, Germany and Croatia, can claim to have been a home cf Neanderthal man.

In our pursuit of fossil remains of the ancient inhabitants of Europe we now pass from Spain to Italy. There is no country in Europe so likely to provide the clues we are in search of as Italy. She is rich in deposits of late pliocene and of pleistocene date, the periods which cover the later phases of man's evolution. These deposits are

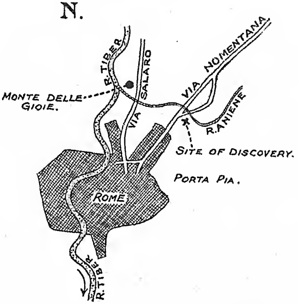


FIG. 118.—A sketch map of Rome and its environs showing the site at which the Aniene skull was found.

usually charged with lime salts and matter of volcanic origin, providing conditions which ensure the preservation of such bones as may have become embedded as deposits were laid down. That Italy was inhabited by man in later pleistocene times has long been known. There are scores of sites [1] which have yielded palaeolithic implements, particularly those of the Mousterian culture. Within 10 miles of Rome, six Mousterian stations are known; within 100 miles of that city 27 such stations have been charted. There ought to be preserved some-

[1] See Raymond Vaufrey, "La Paléolithique italien", *Arch. de l'Instit. Paléont. humaine*, Mem. 3, 1928.

where in Italian deposits the bones of the people who occupied these stations in pleistocene times. Yet it was not until the spring of 1929 that a fortunate chance brought to light for the first time the actual remains of an Italian of the Mousterian period. No less strange is the site of the discovery; it was made almost in the capital of Italy, just outside the city of Rome. This discovery proved that, in mid-pleistocene times, Italy, like the rest of Europe, was inhabited by people of the Neanderthal type.

The site of this remarkable find is indicated in fig. 118. The traveller leaving the ancient city by the old eastern gate—the Porta Pia—finds the Via Nomentana stretching before him, carrying him straight towards the north-east. After a journey of a little more than 2 miles the Aniene is reached, a tributary of the Tiber. As the valley of the Aniene is entered, the traveller observes to his right that a pit or quarry has been opened for commercial purposes. On the sides of the pit are exposed strata laid down during the pleistocene period, when the lower part of the valley of the Aniene formed a lake. At the end of April 1929 the foreman in the pit was digging into a stratum of gravel and sand situated almost 20 feet below the surface soil. He knew that fossil bones occurred in the gravel stratum, fossil bones which the learned had identified as those of *Elephas antiquus*, *Hippopotamus major* and *Rhinoceros Mercki*. At the end of April his pick laid bare the vault of a human skull. With great care the foreman succeeded in extracting the skull intact, with its matrix of calcareous gravel still adhering to the face and base. He carried it to his master, Signor Cassori, who in turn conveyed it to the squire, in this case the Duke of Mario Grazioli. By the latter the skull was presented to the Anthropological Institute of the University of Rome. Professor Sergio Sergi, Director of the Institute, immediately recognized that at last Neanderthal man had been found in Italy. The skull, perhaps the most complete specimen discovered so far, manifested all the cranial characteristics of that ancient and extinct species of

humanity, *Homo neanderthalensis*. Professor Sergi exhibited the newly found specimen to a meeting of the Roman Society of Anthropology on June 1, 1929, and published a preliminary note in the *Rivista di Antropologia*.[1] The only important part missing was the lower jaw. As no other bone of the skeleton was found, nor any sign of a grave discoverable, we must conclude that the skull had become accidentally embedded in the bed of the ancient lake into which the Aniene flowed.

In due course Professor Sergi will publish a detailed

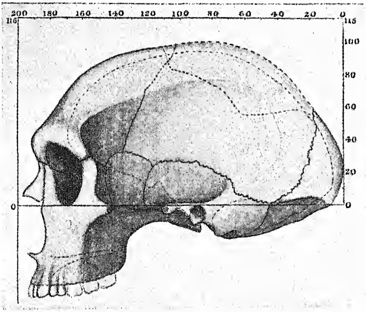


FIG. 119.—A profile of the Gibraltar skull, two-fifths natural size.

account of the Aniene skull. From the photographs which accompany his preliminary note one can see that there is a remarkable degree of resemblance between the newly discovered Italian specimen and the skull found in Forbes quarry, Gibraltar, in 1848. A profile of the Gibraltar skull is given in fig. 119, to remind the reader of its main features. Professor Sergi regards the Aniene skull as that of a woman about 30 years of age. The Gibraltar skull is now generally accepted as that of a

[1] "La Scoperta di un Cranio del tipo de Neanderthal presso Roma", *Rivista di Antropologia*, 1929, vol. 28, p. 3.

woman and representative of the southern Neanderthal race. The supra-orbital torus is rather more pronounced in the Italian skull; part of it has been broken away, exposing two large frontal air sinuses. Professor Sergi estimates that the cranial capacity of the Aniene skull is about 1200 c.c., practically the same as the capacity of the Gibraltar skull. The profiles of the two skulls are almost identical. In the occiput, mastoid and ear regions there are the same modifications, characteristic of Neanderthal skulls. In both there is the same long upper face, with the same fullness of the maxillary region of the face, the same wide and ample nasal aperture and the same long, saddle-shaped nose.

The Aniene discovery is important not only because it has supplied the means of making a more minute survey of the cranial characters of Neanderthal man than has hitherto been possible, but also for another reason. Nearly all the fossil remains of Neanderthal man known to us have been found in caves. There is, however, one important exception. The fossil remains found at Ehringsdorf were engulfed in a naturally formed deposit. There is now another—the Aniene skull. In these two cases we have the opportunity of assessing the antiquity of human fossil remains, not on the scale of a cultural, but on that of a geological calendar. The deposition of the gravel stratum in which the Aniene skull was embedded is assigned by geologists to the long, temperate period which preceded the last glaciation—to the Riss-Würm interglacial (fig. 162, p. 464). It will be remembered that the fossiliferous strata at Ehringsdorf are assigned to the same phase of the pleistocene period. The fossil remains of the same great animals—elephant, hippopotamus and rhinoceros—are found at both sites. At Ehringsdorf the human fossil remains were accompanied by a pre-Mousterian or early Mousterian culture. In the actual site at which the Aniene skull was found no stone implements have been observed, but at several points along the valley Mousterian implements have been found in the fossiliferous gravel. Indeed, one of the most famous

Mousterian sites in Italy was that of Monte delle Gioie, situated on the eastern or right bank of the Aniene just before that stream joins the Tiber (fig. 118). This little hill of travertine has now disappeared, quarried away for building purposes. On its southern aspect there was a cave. On the floor of the cave, which was situated 125 feet above the Aniene, was a stratum of gravel, which yielded the same extinct animals as were found in the skull pit. In the gravel were found Mousterian implements and also antlers of the stag which had been cut by human hands. The evidence justifies us in assuming that the banks of the Tiber, where Rome came to be built many thousands of years later, were inhabited in middle pleistocene times by men and women of the Neanderthal species, altogether different from the modern inhabitants of Italy.

Every year brings forth evidence which helps us to fill in the story of human life in ancient Europe—particularly during that long period when its sole inhabitants were men of the massive-browed, slouching type.

So far we have not succeeded in tracing Neanderthal man by his fossil remains into the west of Europe beyond the Channel Islands (Jersey);[1] although his work-floors have been found in England, no Neanderthal skull or bone has yet come to light. We have also traced the type towards the east of Europe. Until recently Krapina,[2] in Croatia, represented the most easterly discovery of his remains. In 1924, however, M. Bontch-Osmolooski,[3] Conservator of the Russian Museum in Leningrad, announced the discovery of the fossil remains of Neanderthal man in the Crimea, 850 miles to the east of Krapina. The traveller who leaves Sevastopol by rail for the north reaches Simféropol after a journey of 40 miles. Sixteen miles to the east of this town, situated at the northern

[1] See *Antiquity of Man*, vol. i, p. 183. [2] *Ibid.*, p. 195.

[3] My knowledge of this discovery is drawn from notes published by Professor M. Boule in *L'Anthropologie* (1925, vol. 35, p. 403; 1926, vol. 36, p. 604). Professor Boule had an opportunity of examining the tibia and astragalus of the Crimean skeleton and pronounced them as unmistakably Neanderthal in all their characters.

foot of the Yaila Mountains, is the rock-shelter of Kik-Koba. The strata in the floor of the cave are six in number and very sharply differentiated. At a depth of a little over 3 feet three strata are passed through and a fourth is reached, one about 20 inches in depth and composed of a brown clay. In this clay are preserved: (1) ancient hearths; (2) thousands of implements shaped in an early or pre-Mousterian style, reminiscent of the cultures at Krapina and Ehringsdorf; (3) fossil bones of the mammoth, rhinoceros, red deer, etc. Under the fourth or hearth stratum comes a thin sterile layer of clay, and then the sixth or deepest stratum, resting on the bed-rock of the shelter. In this deepest stratum M. Bontch-Osmoloosky unearthed a human skeleton, laid on its side, with knees half-flexed. The interment was probably made by the people living on the fourth stratum. The skull, unfortunately, had perished, but the limb bones were preserved. The discoverer recognized in the skeleton the characteristic traits of Neanderthal man, and this recognition has been confirmed by the highest authority on such matters, Professor M. Boule. Thus in mid-pleistocene times the northern shores of the Black Sea were inhabited by the same peculiar people who occupied the northern and perhaps southern shorelands of the Mediterranean.

We must also consider a claim made by Professor Gremiatzky of Moscow University, which would carry the distribution of Neanderthal man far to the east of the Crimea—to the Northern Caucasus, almost to the frontier of Asia. If the reader consults a map of Russia, he will find the River Kuma, drawing its tributaries from the north-eastern slopes of the Caucasus, flows eastwards to the Caspian. The town of Pyatigorsk is situated in the upper waters of this river as they issue from the hills. In 1918 a canal was being dug in the valley of the Podkoumok, near Pyatigorsk. The strata exposed represented a deposit of loess. The loess was situated over, and therefore later than, a gravel deposit laid down in the last glacial period—the Würm glaciation. In the loess was found the vault and parts of the

face, including the lower jaw, of a human skull. Professor Gremiatzky has published an account of the skull [1] and claims that the Podkoumok man should be regarded as a member of the Neanderthal species, although he also admits that certain neanthropic features are discernible. Fortunately Professor Gremiatzky reproduces photographs of the vault and lower jaw. Those familiar with the diagnostic features of Neanderthal man have only to examine these illustrations to be convinced that the Podkoumok man was altogether of the neanthropic species: his supra-orbital ridges, his teeth and particularly his lower jaws are of a type which we are familiar with in modern man but have never seen in Neanderthal man. It is possible, nay probable, that the fossil remains of Neanderthal man may yet be found in countries bordering on the Caspian and beyond. The Mousterian culture has been found to the south and to the east of the Caspian.

In this chapter we have followed Neanderthal man across Europe, from Spain to Italy, from Italy to the Crimea, and we might have continued our investigation by crossing into Asia and marking his presence in Palestine. All our evidence points to the extinction of the species before the climax of the last (Würm) glaciation. No evidence of his persistence after the earlier phase of the Würm glaciation has been found anywhere. If, then, Neanderthal people were the sole occupants of Europe and Western Asia during the greater part of the pleistocene period, where were our ancestors, the ancestors of neanthropic man, then living? Was it in Northern Africa, as some believe, or was it in South-Western Asia, as others believe? We cannot yet tell, but it is clear that the neanthropic invaders of Europe lived not far away, for they seem to have spread over the country, replacing the Neanderthalians, in a comparatively short period of time.

1 "Die Kalotte des Menschen von Podkoumok", *Russ. Anthrop. Journ.*, 1922, vol. 12, p. 92; "La Mandibule et les dents de l'homme de Podkoumok", *ibid.*, 1926, vol. 16, p. 99.

CHAPTER XXIV

THE DISCOVERY OF THE MAMMOTH-HUNTERS OF MORAVIA

My readers are familiar with the story of Pompeii. In the first century of our era (A.D. 79) this town, looking out on the Bay of Naples and sheltering some 20,000 inhabitants, became suddenly overwhelmed by an outburst of Vesuvius. A century of excavation has thrown the town again open to the light of day. We may walk along its rutted streets, glimpse within its shops and temples, inspect the houses of the rich and of the poor and obtain an intimate knowledge of how people lived in a Roman town eighteen centuries ago. A disaster of the first magnitude has preserved for us a page of human history. An infinitely more ancient Pompeii—one of the palaeolithic period—is now being exposed in the province of Moravia, situated right in the heart of Europe, one which has preserved for us not only the homes and haunts, the handiwork and habits, but also the graves and bones of the Moravians, who successfully tracked the mammoth during a certain phase of the last ice age. The homes of the mammoth-hunters have been overwhelmed and preserved not by a downpour of volcanic ash, but by the slow accumulation of a blanket of loess, a product of frost and flood, drought and wind.

Let us look first at some of the topographical features of Moravia—now part of Czechoslovakia. In extent it does not greatly exceed one of our larger English counties. To the west, north, and east it is bounded by an amphitheatre of hills, while towards the south its flat central lands merge into the Danubian plain. Its chief rivers, the Morava and Dyje, carry their waters to the Danube. Its capital town, Brno or Brünn, lies 65 miles north of Vienna and is situated nearly in the centre of the alluvial amphitheatre (fig. 120). To the north and east of Brünn are limestone hills and caves. The cave known as Pekarna was inhabited by man in palaeolithic as well as in neolithic times (see fig. 121, p. 374). Twenty-five miles to the

south of Brünn the Palava hills rise from the plain, and on their eastern flank is the town of Věstonice (Wisternitz). Near this modern town, as we shall see presently, the mammoth-hunters had an extensive camp, one which covered many hundreds of acres, the most extensive palaeolithic station known to us. On the eastern side of Moravia the amphitheatre of hills is interrupted by a valley, the valley of the Bečva, through which, in these

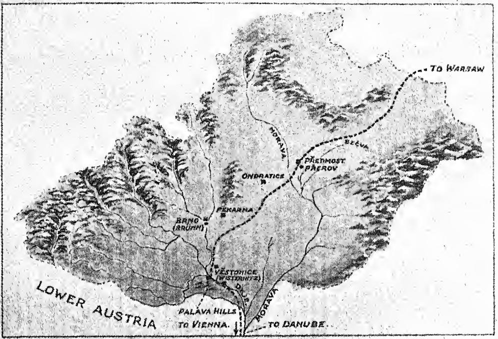


FIG. 120.—A sketch map of Moravia showing the chief sites of palaeolithic discovery. (After Professor D. K. Absolon.)

modern days, there passes the main railway route from Vienna to Warsaw. At the Moravian end of this valley is situated the village of Predmost, two miles beyond the important junctional town, Prerov (Prerau) (fig. 120). The railway traveller, as he enters the valley of the Bečva, making towards the wide plains of Silesia and Poland, has his attention arrested by the fresh picturesqueness of the village of Predmost. Behind it rises up a bluff of limestone, which in ancient times provided a rock-shelter for the mammoth-hunters. From the swelling fields which flank the bluff on the south one obtains an

extensive view of the Moravian plain, but there were other reasons, besides shelter and a wide outlook, which attracted the ancient hunters to the Predmost cliff. The valley of the Bečva in pleistocene times must have served as a highway for migratory herds of game—passing northwards in the spring and southwards in the autumn. Clearly Predmost had great natural advantages to offer to a people who were dependent on the chase for a livelihood.

The extent of the camp and the vast collections of mammoth and other bones, now buried deep beneath deposits of loess, bear witness to the importance of Predmost as a hunting-station in ancient times. Predmost, and the equally important site at Věstonice, which is 60 miles from Predmost as the crow flies, are the most extensive of the 100 loess stations so far discovered within the bounds of Moravia. The town of Brünn itself is built on sites occupied by mammoth-hunters. Thus Moravia differs from other countries in her treasuries of ancient man, for they lie out in the open plain preserved under a mantle of loess, whereas in most other countries we are dependent on what isolated caves have preserved for us. Moravia, as we shall see, has also her cave records.

The steps which led to the discovery of these open stations and revealed the prehistoric riches of Moravia deserve our attention. Moravian archaeologists were late in joining in the search for the records of prehistoric man; their colleagues of France had established the main lines of our present knowledge before they began. Between 1880 and 1886 Dr. Wankel discovered the palaeolithic station at Predmost, and drew attention to the profusion of human implements amongst the fossil remains of mammoth in the loess which had accumulated at the base of the limestone bluff, in some places over 60 feet deep. His work there was continued (1890–94) by Dr. K. J. Maška, who discovered in the loess a remarkable tomb in which the mammoth-hunters had buried their dead. The stratum of loess in which the tomb had been made lay 8½ feet below the present surface. The common grave was oval in shape, measuring

13 feet long by 7½ feet wide. One side of the tomb was bounded by a row or palisade of mammoth shoulder-blades, the other side by lower jaws of mammoth set upright. Within the tomb were the bones of 20 individuals—12 of which were adult, while 8 were at various stages of childhood. In the case of 10 individuals the whole skeleton was represented. In the case of the others, the representation was fragmentary. On the skull of a child was a beautiful Aurignacian necklace such as the mammoth hunters loved to make and wear. In the tomb with the human bones was a skull of the Arctic fox. Over the tomb was placed a protective stratum of stones, 16 inches in thickness. The structure of the tomb, the fossilized condition of the human and mammoth bones, the objects laid with the dead, the undisturbed condition of the overlying strata of loess, 8½ feet in depth, may be accepted as evidence that the bones within the tomb represent the mammoth-hunters. The bodies were evidently laid to rest in a contracted or flexed posture, and we may presume that it was a family or tribal grave in which interments were made from time to time, for it is only under such a supposition that we can explain the disturbed condition of some of the skeletons and the fragmentary condition of others. This is the earliest collective grave of which we have knowledge, for the contemporary graves in France, made usually in caves, had single interments—with the possible exception of the two deepest burials in the Grotte des Infants at Mentone.

Maška's excavations, which revealed the Predmost tomb, ceased in 1894; the next step was taken nearly thirty years later. After the great war Moravia, like other European countries, was in need of new houses, and a company began to make bricks from the loess at Predmost. By 1924 it had cut long deep trenches across the swelling meadows to the south of the limestone bluff, the old rock-shelter. Along the vertical sides of the trench could be traced a stratum containing remains of hearths, fossil bones of mammoth and of other extinct animals in

great profusion, besides thousands of implements and ornaments worked out of stone and bone, many of them of a novel description. The cultural layer varied in thickness from a few inches to 4 feet or more; it lay from 7 to 14 feet below the present surface of the land, and extended along the whole length of the trench and apparently far beyond the limits of the brickfield. Objects were met with in such numbers as to embarrass the workmen. As many as 2000 separate vertebrae of the mammoth were gathered. In one pocket was found a collection of 13 broken mammoth tusks; a heap of wolf skulls, 12 in number, each of them opened apparently for the extraction of the brain; in another part of the cultural stratum, which represented the old land surface on which the mammoth hunters lived, 50 molars of the mammoth had been assembled.[1]

Under these circumstances the Czechoslovakian Government intervened and obtained permission for the able curator of its Museum in Brünn, Dr. K. Absolon, to take charge of all archaeological objects which came to light as the working trenches were extended. Thousands of accurately attested objects have thus been collected for the Government Museum in Brünn, objects which throw a clear light on the habits, attainments, culture and mentality of the mammoth hunters. Besides collecting from the brick-pits, Dr. Absolon made independent excavations in another part of the old camping-station, and in 1928 had the fortune to expose over a hearth in the cultural layer another skeleton—that of a man. The skull was not found, and one of the thigh bones was scored by sharp cuts, as if the flesh had been stripped from the bone by the use of a stone knife. There is here a suggestion that the mammoth-hunters may have been addicted to cannibalistic practices.[2]

[1] l'Abbé H. Breuil, "Les Industries paléolithèques du Loess", *L'Anthropologie*, 1925, vol. 34, p. 315.

[2] Dr. K. Absolon has contributed preliminary accounts, with numerous illustrations, of the cultural objects found at Predmost and other Moravian stations to the *Illustrated London News*, October 31, 1925, *et seq.*, November 16, 1929, *et seq.*

In 1924 Dr. Absolon began to give his attention to the open station at Věstonice, which, as we have seen, is situated at the foot of the Palava hills, 60 miles distant from Predmost. Preliminary soundings have shown that the camp of the mammoth-hunters here covers a wider area than at Predmost. At least 1000 acres of the plain were occupied. The cultural stratum here lies at a varying depth; it may almost crop out at the surface, or it may be buried beneath 14 feet of loess. As yet only about one-third of an acre of the camp has been explored, and the reader must think of the toil and expense incurred in uncovering even this small area. The method used is exactly the same as that which had exposed the streets and houses of Pompeii. All the overlying loess is removed until the cultural stratum is reached. The objects in the cultural layer are then cleared and exposed *in situ*, and thus is restored the old land surface on which the mammoth-hunters lived, with the hearths round which they sat, the objects which they collected and treasured, the refuse they threw away and the springs from which they obtained water. Collections of the hip bones of mammoth are assembled in one place, tusks in another, molar teeth in a third and animal skulls laid open for the extraction of brains in a fourth. In one small area there was a midden heap in which the bones of sixty mammoth skeletons were gathered; the animals so represented were of all ages, from the very young to the very old. Ornaments, idols, fetiches, pigments, palettes, toilet oufits, needle-cases, spoons, all kinds of implements and weapons of bone and ivory were found in abundance. Work-floors and pits were uncovered; some of the pits were large enough to have served as traps for great game. Bone implements and utensils of strange design were abundant. It is remarkable to find these mammoth-hunters modelling crude human figures out of a specially prepared clay, seeing that they knew nothing of pottery. When they engraved female figures on the ribs of the mammoth, they emphasized the parts concerned in generation. Their engravings of the human figure follow a geo-

metrical pattern, but animals such as the mammoth and cave bear they carved or modelled in a lifelike manner.

Although the handiwork of the mammoth-hunters abounds in the cultural layer at Věstonice, of their graves, skulls and skeletons very little has been discovered so far. At one place Dr. Absolon found the burial of a child; its bones were red with ochre and placed under the shoulder-blade of a mammoth. With the skeleton was a necklace made out of the teeth of the Arctic fox. In another place he found a remarkable object, a human skullcap, rounded at the brim and apparently used as a drinking-cup, the earliest example of its kind known to archaeologists. The skull of a wolf had been cut open to serve—so it is believed—as a lamp. The animals hunted and killed were the mammoth, woolly rhinoceros, bison, aurochs, cave and brown bear, lion, wolf, hyaena, Arctic fox, stag and reindeer.

Brünn itself, the capital town of Moravia, has been built on a locality which had been occupied by generations of mammoth-hunters.[1] So long ago as 1888 a human skeleton was discovered in the loess deposit near Brünn and was described by Professor A. Makowsky.[2] Its imperfect skull is usually spoken of as Brünn No. 2. In 1891, when a trench was being dug along Franz-Joseph Strasse in the heart of Brünn, and when it had reached a depth in the loess of 15 feet, a burial was encountered—that of a big-headed man. It also was described by Professor Makowsky, and its skull, of which a description is given elsewhere,[3] is known as Brünn No. 1. Then in 1927 was discovered Brünn No. 3 in a suburb to the north-west of the town. Dr. Absolon had wisely taken the public Press into his confidence and begged to be advised if human bones were encountered in the course of excavations. The grave of Brünn No. 3 was exposed when foundations were being dug for a

[1] Dr. J. Skutil, "Bericht ueber eine neue im jahre 1929 endeckte palaeolithische Station in Brünn", *Mitteil. aus der Palaeolith. Abteil am Mähr Landsmuseum*, 1930, No. 12.

[2] *Mitteilung. Anthrop. Gesellsch.*, Wien, 1892, vol. 22, p. 73.

[3] See *Antiquity of Man*, vol. i, p. 103.

house. The body lay in a semi-contracted position at a depth of 7 feet. Over it were three strata, the uppermost, 3 ft. 3 in. in thickness, representing soil and loam; then came a thin stratum of loess only 6 in. in thickness; then a stratum of sand and gravel, 3 ft. 3 in. in thickness. Under the third stratum came the fourth, made up of gravel. The body, which had been besmeared with red ochre, lay between the third and fourth strata, at a depth of 7 feet.[1] Although no cultural objects were found with the skeleton, which was that of a woman, yet its relationship to the stratum of loess, its ochre coating, and other circumstances, leave no doubt that this woman lived in Moravia in the time of the mammoth-hunters. An account of the discovery of this skeleton has been published by Dr. Absolon[2] with a description of its anatomical characters by Professor J. Matiegka of the University of Prague.[3]

Thus from Predmost and from Brünn we have representations of over a score of individuals to guide us to a knowledge of the racial nature of the Moravian mammoth-hunters. Before, however, we proceed to examine the skulls and other human bones, let us see how far it is possible to fix the date at which these ancient Moravians were alive. The loess in which their camps and bones are embedded is a product of a certain phase of the last period of glaciation, one which is marked by an amelioration of climatic conditions. The Moravian loess represents the upper or more recent loess of Western Europe, and like the western loess the objects of human workmanship which it contains are those of the Aurignacian culture. Further, the loess of Predmost rests upon the lowest terrace of the neighbouring stream, the Bečva, and as this terrace was formed during an early phase of the last glaciation—at the period when the Mousterian culture was practised by the Neanderthalians of Europe—

[1] It is important to note that the sand and gravel strata represent component parts of the lowest terrace laid down by the neighbouring stream in the opening phase of the last glaciation.

[2] *Anthropologie* (Prague), Hrdlička Anniversary Volume, 1929, vii, p. 79.

[3] *Ibid.*, p. 90.

it is clear that a considerable interval of time had elapsed between the passing of Neanderthal man and the occupation of Moravia by the mammoth-hunters. The skeleton of the woman found in a suburb of Brünn in 1927 bears out this contention. She lay under a stratum of loess and upon a deposit of the lowest (Mousterian) terrace of the neighbouring stream.[1]

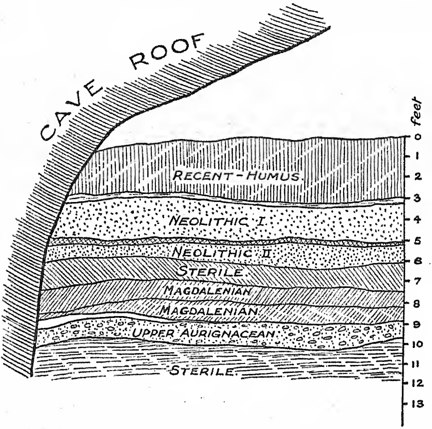


FIG. 121.—Diagrammatic section of the strata of the Moravian cave, Pekarna. (After Dr. Absolon.)

We obtain a more precise estimate of the antiquity of the mammoth-hunters from Dr. Absolon's exploration of Moravian caves, particularly that of Pekarna, situated in the hills to the north-east of Brünn (fig. 120). A section of the strata of this cave is reproduced in fig. 121. The section extends to a depth of 12 feet, the deepest layer,

[1] As to the geological and cultural evidence bearing on the antiquity of the lowest terrace and loess deposits, see "Geologie des Předmoster Diluviums", by Dr. Karl Zapletal, *Acta Musei Moraviensis*, 1929, xxvii, p. 1.

2 feet in thickness, being sterile. Over this comes a thin and irregular stratum (not depicted in fig. 121), containing the earliest culture so far discovered in Moravia. The culture has certain resemblances to the Mousterian and has been called pseudo-Mousterian and also primitive Aurignacian. Over this follows a stratum a foot in thickness, rich in the same cultural objects and fossil animal bones as are found in the loess deposits of the open plain—at Predmost and Vêstonice. It represents the culture known as upper or more recent Aurignacian. Over the Aurignacian strata come two layers containing remains of reindeer, and of horse and objects assignable to the Magdalenian culture, the last of the cultures of the ice age in Europe (see fig. 162, p. 464). Over the Magdalenian stratum comes a "sterile" layer formed during a long period in which the cave was uninhabited by man. Then follow two layers, over 4 feet in thickness, formed during the period of neolithic culture. After these were laid down came the uppermost deposit of all, containing objects of the bronze and later periods.[1]

Thus the geological, cave and cultural evidence permits us to make a fairly definite statement as to the period of the Moravian mammoth-hunters. On the scale of reckoning used in this work, we presume that the period of Aurignacian culture came to an end in Europe some 15,000 years ago (see chart, p. 464); and that the date of the mammoth-hunters lies somewhere about 15,000 or 20,000 years before our era; it may be 5000 more, but it cannot be 5000 years less. We have a right to presume that the mammoth-hunters—people of the Predmost type—were the contemporaries of the Cromagnon folk of France.

[1] "Die palaeolithische Erforschung der Pekarna-Höhle in Mähren", by Dr. K. Absolon and R. Czizek, *Acta Musei Moraviensis*, 1927, parts 1, 2.

CHAPTER XXV

THE PREDMOST TYPE

Let us now sum up what we know of the outward appearance and inward structure of these early inhabitants of Moravia. We can know only what can be learned from their skulls and skeletons found in the common tomb at Predmost and in the graves discovered under the foundations of Brünn. There can be no doubt, I think, that the Brünn and Predmost people are of the same race; the Predmost type may stand for both. So far the only precise information we have concerning this type is contained in communications made by Makowsky [1] concerning the earlier discoveries at Brünn and from a preliminary description given by Professor J. Matiegka [2] of the University of Prague concerning the remains found at Predmost as well as at Brünn. The latter promises a full report on the Predmost remains at an early date. Meantime the data which I give and the conclusions I have reached are based upon examination of casts of two Predmost skulls which Dr. Absolon has kindly placed at my disposal.

The skull cast I have before me is that of the strongest man (No. 3) found by Dr. Maska in the collective tomb at Predmost. An exact drawing of the profile of the skull is reproduced in fig. 122. The strength and dimensions of the skull are altogether exceptional. The skull, as will be seen from the drawing, has been oriented on the Frankfort plane (F.P.) and placed in a framework of lines which is 200 mm. long and 120 mm. high. Notwithstanding these large dimensions, the skull exceeds the framework both in length and height, its length being 202 mm. and its height (auricular) 122 mm. The corresponding measurements of the Brünn skull (No. 1) are

[1] Makowsky, A., *Mitth. Anthrop. Gesellsch. in Wien*, 1892, vol. xxii, p. 73.

[2] Matiegka, J., "New Finds of Fossil Skulls in Moravia", *Anthropologie* (Prague), 1929, vol. vii, p. 79.

even greater: length 206 mm., height 125 mm.[1] The Predmost skull (No. 3) has been compressed and somewhat distorted, but its original width cannot have been less than 145 mm., about the same as in Brünn No. 1. From these dimensions one estimates that the size of brain in this Predmost hunter was about 1580 c.c.—100 c.c. above the mean for modern Englishmen, while

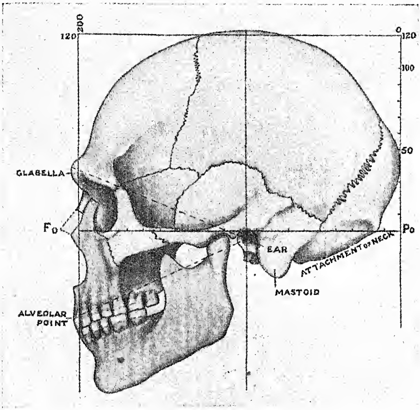


FIG. 122.—Profile of the Predmost male skull (No. 3) oriented on the Frankfort plane (F.P.), and placed within a framework 200 mm. long and 120 mm. high.

the cranial capacity of the Brünn skull was still greater, about 1600 c.c. The Predmost people, like their Cro-magnon cousins living in France, were large-headed and long-headed, the width of the skull being 70–72 per cent. of its length. Brain casts have been taken from the interior of four of the Predmost skulls, two male and two female.[2] These show the Predmost brain to have been

[1] See *Antiquity of Man*, vol. i, p. 104, fig. 36.

[2] Dr. C. U. Ariëns Kappers, "The Frontal fissures on the Endocranial casts of some Predmost men", *Proc. Roy. Acad. Science, Amsterdam*, 1929, vol. 33, No. 5.

not only voluminous, but also rich in convolutions and well developed in those "higher" regions which are regarded as serving as "association centres". There was no lack of brains amongst the ancient mammoth-hunters of Moravia. Their culture reveals a prolific artistic ability.

Amongst the Predmost people, as amongst the Cro-magnons, the men were much bigger-boned and more muscular than the women. The Cromagnon men of the south of France were tall, often attaining a stature of almost 6 feet, while their women were of moderate stature, 5 ft. 4 in., or less. The Predmost men, although muscular and strong, were not tall, about 5 ft. 6 in. or 5 ft. 7 in. may have been their mean height, and in many cases, if not in all, the women were under 5 ft. 4 in. The men, as we shall see, had the bony ridges of their skulls robustly developed, with jaws which were exceedingly large and strong, while in the women the cranial ridges were weakly developed as a rule and their jaws of moderate development. The sexual differences are particularly well seen when we compare the skull of the Brünn woman with that of the Predmost man, represented in fig. 122. The woman had a small skull, the length being only 181 mm., its width 127 mm. and its auricular height 113 mm., giving a volume of brain estimated at 1250 c.c.—330 c.c. less than in the man. Although she was over 30 years of age, she had retained, as is common amongst women of modern races, many of the cranial characters of adolescence—the brow ridges and occipital ridges being but slightly developed. This, however, was not always the case amongst Predmost women. In fig. 123 is reproduced a drawing in profile of the skull of one of the women found by Dr. Maska in the common tomb at Predmost. It is placed within a framework of lines designed to take the skull of an average modern English-man—being 190 mm. long and 115 mm. high. This woman's skull exceeds the framework in length and height, its length being 193 mm. and its height (auricular) 118 mm. Its width is also great—143 mm., being 74 per

cent. of the length. She was moderately dolichocephalic and large-brained, for her cranial capacity was at least 1500 c.c.—200 c.c. more than that of the average English-woman's skull. Further, the muscular markings of this Amazon—the eyebrow ridges, the mastoid processes and other bony elevations which give attachment to the neck—are developed almost to a masculine extent. On the other

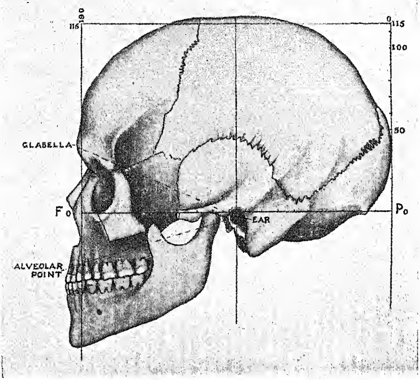


FIG. 123.—Profile of skull (No. 4) of a Predmost woman. It is oriented on the Frankfort plane (F.P.), and placed within a framework of lines—190 mm. long and 115 mm. high.

hand, her teeth, jaws and conformations of her face assure us of her femininity.

The people who inhabited Moravia in the period of Aurignacian culture and lived on the natural produce of the country were long-headed and big-brained, but having ascertained this much we are still far from our goal—the determination of their racial nature and of their relationship to living races. We have no reason to believe that the human brain has increased in size with the rise and spread of civilization, but we have reason to suspect

that the people who have adopted civilization have undergone a reduction in tooth and jaw development, with an accompanying change in their facial features. In this work the area of the dental palate has been employed as an index of tooth and jaw development.[1] In fig. 124 are represented the dental palates of the two Predmost skulls represented in figs. 122, 123. In area the male palate exceeds that of modern Europeans and rivals the largest palates of the male aborigine of Australia. Its length is 58 mm.—8 mm. more than is common in modern

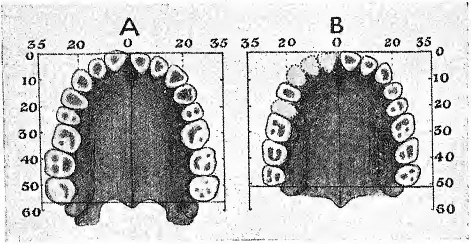


FIG. 124.—(A) The dental palate of the Predmost male (No. 3) compared with (B) That of the Predmost female (No. 4).

Europeans; its width, measured between the outer surfaces of the second pair of molars, is 64 mm.; its total area, measured within the outer margin of the dental arcade, is 33 cm.^{2}—8 cm.^{2} more than the mean for modern Europeans and 1·4 cm.^{2} above the mean for the palate of male aborigines of Australia. The woman's dental palate falls short of the man's in all dimensions; its length is 51 mm., its width 62 mm., its area 25 cm.^{2} Her palate was as big as that of the average European male and 5 cm.^{2} larger than the mean for modern women. They had a fully developed dental system. For example, the lower molar teeth of the woman found in Brünn (No. 3) had a total crown length (medio-distal) of 31 mm., the

[1] See *Antiquity of Man* vol. ii, p. 659.

last molar being somewhat longer than the first. The molar crowns in the upper jaw of the man had a total length of 31 mm., the teeth diminishing in size from first to third. In development of tooth, palate and jaw the Predmost people differed very little from the Cromagnons of France. In the case of both peoples we have no difficulty in conceiving that by a process of reduction their teeth and jaws could have been transformed into the palatal structures of modern Europeans.

There are certain remarkable features of the Predmost face which deserve our attention, particularly as it has been alleged that they show certain affinities to the Neanderthal type. For example, the supra-orbital ridges are massively developed in all skulls of the Neanderthal type; they are developed in the male Predmost skull to an extent beyond that seen in modern Europeans and to a degree found only in Australian aborigines amongst living peoples. For instance, when we take the width of the supra-orbital region of the forehead in the male Predmost skull (No. 3), it measures 117 mm., which falls within the lower limits of similar measurements made on Neanderthal skulls, in which the supra-orbital width varies from 115 mm. to 124 mm. In male Australian aborigines the mean supra-orbital width is 112·6 mm.; in modern Englishmen 106·8 mm. While the supra-orbital ridges in the male Predmost skull greatly exceed in their lateral development that of the modern European and fall within the lower limits of Neanderthal development, yet in their conformation and in their distinct separation into supraciliary and supra-orbital elements they are altogether modern in character and unlike the condition met with in Neanderthal skulls.

The great development of the Predmost supra-orbital ridges can be brought out by another measurement. The total length of the Predmost male skull (No. 3), including the thickness of the supra-orbital ridges, is 203 mm.; of this amount 188 mm. is made up of brain space and 15 mm. of bony walls. The brain space makes up 92 per cent. of the total length, the bony walls only

8 per cent., just as is usual in modern European skulls, whereas in skulls of Neanderthal males, so greatly developed is the supra-orbital torus, that the bony walls usually form 16 per cent. and the brain space only 84 per cent. of the total length. The supra-orbital ridges in the skulls of the Predmost women are altogether modern in character; there is no suspicion of a Neanderthal affinity in them.

In the discrimination of one human race from another we depend to a large extent on the characters of the face. In the case of Brünn skull No. 1, the face was missing and hence there was doubt as to race, but seeing how like the calvaria of the Brünn skull is to that of the Predmost male (No. 3), there need be no hesitation in presuming that the Brünn man had a face of the Predmost type. Now when we measure or examine the facial features of the Predmost skulls (figs. 122, 123), we find reason to believe that we are dealing with a European people of a primitive type. The man has a long face; its total length from nasion to the lower border of the chin is 126 mm. That is not an uncommon length amongst modern Europeans. Of the elements which make up the facial length we notice, first, that the nasal part was long—60 mm.; the nose was long and wide—27 mm. The upper face was also long; from nasion to upper alveolar point the male face measures 77 mm. The lower or mandibular part of the face, 37 mm. as measured by the depth of symphysis, was also well developed. The width measurements of the male face are far above the mean for modern Europeans. We have already noted the great supra-orbital width 117 mm.; the forehead, although not high, was wide—103 mm.; the zygomatic arches were far apart—141 mm.; the cheek bones were prominent, the bi-maxillary width being 98 mm. The face below and in front of the ears was wide, the jowls or angles of the jaw being 106 mm. apart.

In its length and width measurements the face of the Predmost man was remarkable, but its most significant characters are best realized when the skull is studied in

profile (fig. 122). In this aspect we observe that the brain-containing part of the skull is divisible into two parts, a hinder or post-auricular part to which the neck is attached and a front or pre-auricular part to which the skeleton of the face is attached. In fig. 122 a vertical line has been drawn through the centre of the ear passage to separate these two parts of the skull. We are struck by the length of the pre-auricular part of the Predmost man's skull; the pre-auricular part, measured from the prominent glabella (fig. 122) to the vertical ear plane, is 108 mm.—more than 10 mm. above what is usual in skulls of any modern race and equal to the measurements found in the larger Neanderthal skulls.[1] Now we have seen that the jaws of Predmost man are large, but the great forward projection of the forehead masks their forward development. There is no apparent prognathism, no apparent muzzle, because the maxillary part of the face is overshadowed by the long pre-auricular part of the skull. Yet the Predmost face is not only long and wide, but also deep. Its depth is best estimated by two radial lines drawn from the central point of the ear passage, one passing to the glabella, the other to the upper alveolar point (fig. 122). The first of these radii measures 115 mm., the second 118 mm. These measurements help to bring out the exceptional development of the face of the mammoth-hunters, yet if we suppose that there has been a reduction in the jaw developments among Europeans in the many thousands of years which have passed since the period of Aurignacian culture, there is no difficulty whatever in supposing that the face most prevalent among modern Europeans has been evolved directly from massive faces of the Predmost type. A reduction of 10 mm. in the auriculo-glabellar radius, and one of 15 mm. in the auriculo-alveolar, will give to the Predmost skull the same dimensions as are seen in the average modern Englishman. All the evidence to be gleaned from craniology leads me to regard the Predmost—and also the Cromagnon peoples—as proto-Europeans.

[1] For further details, see *Antiquity of Man*, vol. ii, p. 409.

An examination of the female skulls throws light on the racial nature of the Predmost people. In them the forward projection of the maxillary part of the face—the degree of prognathism—is much more evident. This is due, in the first place, to the shortness of the pre-auricular part of the skull. In the specimen depicted in fig. 123 the glabella stands 98 mm. in front of the vertical auricular plane—10 mm. less than in the male. In Brünn No. 3 the pre-auricular part of the skull measures only 86 mm. The jaws, as we have seen, although much smaller than in the Predmost male, are yet well-developed and, owing to the relative shortness of the pre-auricular part of the skull, appear to be prominent. The length and width measurements of the female Predmost face are also much less than those of the male. In the skull shown in fig. 123 the total length of the face is 108 mm., of which the upper face makes up 64 mm. and the lower jaw 28 mm. In this specimen (No. 4) the width measurements are considerable: frontal minimum, 99 mm.; supra-orbital 105 mm.; bizygomatic 133 mm.; bimaxillary 87 mm.; and bigonial 94 mm. —dimensions which, although great, are still attained in the faces of many modern European women. Her nose was moderate in length (49 mm.) but very wide (28 mm.). The face of the Brünn woman (No. 3), although of about the same length as the Predmost woman, is much narrower. Dr. Matiegka gives her bizygomatic width as 114 mm. Her nose was longer and narrower than that of the Predmost woman. In both, in spite of the alveolar prognathism, there is a well-developed chin. A well-developed chin is a mark of the white or Caucasian race.

It has been necessary to enter somewhat fully into the conformation of the face of the Predmost people in order that we might obtain a basis for discussing their racial affinities. Now Dr. Matiegka has drawn attention to the many points in which the woman's skull, known as Brünn No. 3, resembles the male skull of Combe Capelle —which, on archaeological evidence, has a right to be regarded as one of the earliest Aurignacian inhabitants of France. Both have narrow, flat-sided, long and high

skulls, with a considerable degree of prognathism in their faces, a combination of characters which has led anthropologists to regard the Combe Capelle man as a representative of a negroid people, a people showing a close affinity to the darker-skinned races of Northern Africa. We meet with the same "negroid" features amongst members of the Cromagnon race; the deepest and oldest burials in the Aurignacian strata of the Grimaldi cave gave us two such "negroids," one a woman, the other a youth. I have shown elsewhere [1]—and I am glad to find that Professor Elliot Smith [2] and Dr. Morant [3] agree with me in this—that there is no good reason for separating these so-called negroids from other members of the Cromagnon stock; they have the essential features of that stock; intermediate forms link the negroid to the more common Cromagnon type. It is of interest, therefore, to find the same "negroid" variety occurring amongst the Aurignacian people of Moravia. The Combe Capelle type so definitely represented in the Brünn woman's skull comes out again in several of the female skulls from Predmost. The female skull represented in fig. 123 is intermediate in type; it shows resemblances to the "negroid" Brünn woman and to the typical Predmost man (fig. 122). Now if we suppose that both the Cromagnon and Predmost peoples were of hybrid origin—formed by the amalgamation in Europe of two peoples, a negroid and a proto-European or Caucasian—then we can offer an explanation for the occurrence of "negroid" individuals amongst these early Europeans. I do not believe such an explanation is the true one. We must explain the origin of human races on an evolutionary basis; we have to presume that black, yellow and white races are traceable back to a common ancestry, in which was combined actually or potentially the characters which ultimately became differentiated in black, yellow and white races of mankind. We should

1 See *Antiquity of Man*, vol. i, p. 100.
2 *Evolution of Man*, 2nd ed., 1927, p. 138.
3 "Studies of Palaeolithic Man", *Annals of Eugenics*, 1930, vol. iv, parts i, ii.

expect the earlier forerunners of white races to still possess some of the negroid traits of the common ancestor. Even amongst modern communities of the purer Mediterranean stock, such as the inhabitants of Sardinia and Corsica, individuals marked by all the negroid traits, which we have enumerated above, are not uncommon. Note has also to be made of the fact that these traits are much commoner amongst women than amongst men. I therefore look upon the Cromagnon and Predmost peoples as early and nearly related representatives of the white stock, both retaining certain negroid tendencies.

Where did the Cromagnons and Predmostians live before they appeared in Europe in Aurignacian times, some 20,000 years ago or more? They were not evolved in Europe, for down to the end of Mousterian times the inhabitants of Europe were of the Neanderthal type.[1] The earliest representatives of neanthropic (Aurignacian) man in Europe which have been discovered so far are the Combe Capelle man and the so-called Grimaldi negroids. These discoveries, both made in France, lead us to believe that the appearance of neanthropic man in Europe followed immediately upon, or may have brought about, the extinction of its Neanderthal inhabitants. The sequence of events does not appear to have been quite the same in Moravia as in France. So far fossil remains of Neanderthal man have not been found in Moravia. Dr. Absolon[2] assures us that a true Mousterian culture—the Mousterian of France—does not occur in Moravia. There is no certain evidence that Moravia was ever inhabited by Neanderthal man. The oldest Moravian culture, represented in the basal stratum of Pekarna (fig. 121) and at Ondratice (fig. 120), is one which is described as proto-Aurignacian or pseudo-Mousterian. Dr. Absolon holds that this culture is not European, but Asiatic in origin. If this is so, then it is probable that the Predmostians were also Asiatic in origin.

Such an origin finds support on other evidence. When

[1] The Neanderthal problem is discussed at p. 10, vol. i of *Antiquity of Man.*

[2] See reference on p. 370.

we seek amongst known human races, both living and extinct, for the nearest representatives of the big-brained, long-headed, strong-faced type which brought the Aurignacian culture to Europe, we find the area of our search is limited to a certain part of the world. There is no evidence of the existence of such a type in those regions of Asia now inhabited by Mongolian races, nor in India, Australia or Africa. The type of which we are in search is best represented by the Caucasoid or white stock which now extends from India to Ireland, and has overflowed into other parts of the world. The question is: Where were the ancestors of the Cromagnon and Predmost people in Mousterian times? Europe was then inhabited by men of the Neanderthal stock. The evidence, such as it now stands, leads us to regard the south-western region of Asia as the cradle of evolution of the white man, and that in the Cromagnons and Predmostians we have the European pioneers of this stock. The modern Arab is probably a direct descendant of the stock which, in pleistocene times, gave Europe its first neanthropic invaders. Such a theory serves better than any other to explain the regional distribution of the great living stocks of mankind. There is, on the other hand, a strong school which regards Africa as the most likely homeland of the Caucasian stock—both ancient and modern. In pleistocene times the desert regions of the northern half of Africa could and did provide a habitation for man. The important discoveries made by Mr. L. S. B. Leakey in East Africa certainly support the theory which points to Africa as the land in which the Aurignacian culture had its origin and its earlier developments. Yet for anthropological reasons which I have already given[1] I look upon the south-western part of Asia as being the homeland of the original stock of the Cromagnon and Predmost peoples rather than Northern Africa.

[1] See Chapter X, p. 170.

CHAPTER XXVI

EUROPEANS OF THE MAGDALENIAN AGE

In previous chapters we have been considering recent discoveries which throw light on the kind of people who lived in Europe during the last great ice age. That age, as the reader will see from the time chart (p. 464), is presumed to have affected Europe for a period of about 25,000 years. Arctic conditions did not proceed to a climax and then gradually give way to our milder climate; between the first and last exacerbations there was a long interval—an intraglacial interval—when cold conditions prevailed, but of a kind which permitted Europeans to camp in the open as at Predmost and Solutré. It was in this intraglacial interval that the Cromagnon and Predmost peoples appeared in Europe bringing with them the Aurignacian culture. It was then, or before then, that the Neanderthal type disappeared from Europe, their culture—the Mousterian culture—coming to an end about the same time. During the intraglacial phase, to which we provisionally assign a duration of 7000 years, Europe was given over to the big-brained and stout-jawed men who practised cultures known as Aurignacian and Solutrean. We have already considered the people of these periods, the Cromagnons, Predmostians and Solutreans,[1] and we must now pass on to ascertain what recent additions have been made to our knowledge of the people who lived in Europe during the final phase of Arctic severity. Their culture is known as Magdalenian, and their existence is presumed to cover a period of some 3000 years (see time chart, p. 464).

Before, however, proceeding to examine the remains of men who lived in Europe during the Magdalenian period, it may be well to pause for a moment and ask for an explanation of an intraglacial change in climate. My friend, Dr. G. C. Simpson,[2] without knowing the difficulties which have confronted us, seems to me to have

[1] See *Antiquity of Man*, vol. i, p. 90.

[2] *Nature*, 1929, vol. 124, p. 988.

given us an acceptable explanation. The temperature of the earth, Dr. Simpson holds, depends on the radiation which it receives from the sun; if there is a period of increased radiation, then all parts of the earth become warmer, but the Equatorial zone responds to a much greater degree than does the Arctic zone. As the earth becomes warmer, the difference between Equatorial and Polar temperatures becomes greater. The result of an increased radiation is twofold: the warmer air can take up more moisture, and the difference in temperature between the Equatorial and Polar belts being much greater, there are vastly increased currents of air passing from torrid to frigid zones, carrying vapour which is deposited as snow or as rain at the circumpolar zones. If, on the other hand, a period of decreased radiation sets in, opposite effects are produced; the colder air of the Equator loses its power to hold vapour and the air currents which pass from the Equator to the poles of the earth fail, because the Equatorial zones have cooled to a greater degree than the circumpolar zones. Thus the phases which favour the precipitation of rain as snow in the circumpolar regions of the earth are the opening and closing phases of a glacial period. The opening or increasing phase—the Mousterian—of the last glaciation was a period of precipitation, with great formation of snow and glaciers in Northern and Central Europe. So was the final or decreasing phase—the Magdalenian; while at the climax (the middle phase) came a long dry spell, the period of loess formation, during which Europe was inhabited by the mammoth-hunters. It is thus we seek to explain the peculiar climate which fell upon Europe during the middle phase of the last glaciation, the phase in which fall the Aurignacian and Solutrean cultures.

Who were the people who inhabited the continent of Europe during the final phase of the last ice age, the period of Magdalenian culture? Nearly all the discoveries which have revealed the Europeans of the Magdalenian period have been made in France. There is, in the first

place, the discovery which brought to light the man of Chancelade[1]; in the second place there are the fossil remains of three individuals discovered in a rock-shelter in the valley of the Roc by Dr. Henri Martin,[2] a discovery published in 1927. The site of this discovery lies less than 30 miles from Chancelade (fig. 115, p. 353). Not far away is La Quina, a Mousterian station which the explorer of Roc has made known to all the world. In the same department of France, Charente, is the Grotto du Placard, a Magdalenian site opened by M. de Maret in 1881.[3] This yielded the skeleton of a woman, the third example on our list of Magdalenian representatives. Our fourth example, from one of the best-known Magdalenian caves of France, Laugerie-Basse, is situated on the eastern bank of the Vézère, almost facing Les Eyzies and not far from La Madeleine—the typical station of the Magdalenian culture (fig. 115). Laugerie-Basse was explored by Massénat in 1872, remains of four individuals being unearthed at a depth of 13 feet from intact Magdalenian deposits. The fossil bones represent two men, one woman and a child, but only two skulls were sufficiently intact to serve as guides to race, one being that of a man, the other of a woman.[4] For our fifth representation of the Magdalenian people we have to ascend the valley of the Rhone until the department of Ain is reached, bordering on Switzerland. On the eastern bank of the River Ain, some five miles above Poncin, is a rock-shelter known as Genière, which has been very skilfully explored by Messrs. Gaillard, Pissot and Cote.[5] From an intact stratum

[1] See *Antiquity of Man*, vol. i, p. 80. Dr. G. M. Morant has rendered a great service to Anthropology by examining, measuring and photographing all European skulls of late palaeolithic date. His monograph is published in the *Annals of Eugenics*, 1930, vol. 4, pp. 109–204, with 12 plates.

[2] Dr. Henri Martin, "Caractères des Squelettes humains Quaternaires de la vallée du Roc", *Bull. Soc. d'Anthrop.*, 1927, vol. 27, p. 103. For an account of the explorations, see *Archives de l'Institut de Paléontologie humaine*, Mem. 5, 1928.

[3] See E. T. Hamy, *Congrès Internat. d'Anthrop.*, Paris, 1889, p. 433.

[4] See E. T. Hamy, *Congrès Internat. d'Anthrop.*, Paris, 1889, p. 433. Also G. Hervé, "La Race des Troglodytes Magdaléniens", *Rev. de l'École d'Anthrop.*, 1893, vol. 3, p. 173.

[5] "L'Abri préhistorique de la Genière", *L'Anthropologie*, 1927, vol. 37, p. 1.

of the Magdalenian Age they recovered the skeleton of a child aged about 8 years. Our sixth example also comes from the department of the Ain—from the Grotte des Hoteaux, near the small town of Rossillon, 25 miles to the south-east of La Genière. This cave was explored in 1894 by Messrs. Tournier and Guillon; the skeleton of a youth was found under Magdalenian deposits.[1] For further examples of the Magdalenian Europeans we have to visit the extreme south-west region of France. In the Duruthy rock-shelter at Sorde, in the department of Landes, two skeletons, one of a man, the other of a woman, were discovered (fig. 115). These skeletons were accepted by Mr. E. T. Hamy as being of Reindeer (Magdalenian) Age.[2] The remains of the skeleton of a man from the Magdalenian deposits of the cave near the village of Bruniquel (fig. 115) on the Aveyron must also be added to our list.[3] The only certain representatives of Magdalenian Europeans, outside the bounds of France, are the Obercassel man and woman from a deposit on the right northern bank of the Rhine, a little above Bonn,[4] and the Langwith skull [5] from a cave of the reindeer age in Derbyshire, England.

Thus, to reconstitute the people who lived in Europe during the fierce and final phase of the last ice age—a phase which we are supposing to have endured 3000 years, certainly an under-estimate—we have the remains of only 17 individuals at our disposal, 10 men, 5 women and 2 children—drawn from ten sites. Now as to the racial nature of the Magdalenian Europeans, there is at present a sharp divergence of opinion. When preparing the last edition of *Antiquity of Man* (1925), I made a detailed study of the Chancelade skull and bones, and came to the conclusion that they represented an aberrant and exceptional form of the more ancient Cromagnon

1 *Les hommes préhistoriques dans l'Ain*, Bourg., 1895.
2 E. T. Hamy, *Bull. de la Soc. d'Anthrop.*, 1874, vol. 9, p. 814
3 Quatrefages and Hamy, *Crania Ethnica*, 1882.
4 The Obercassel remains are described in *Antiquity of Man*, vol. i, p. 106.
5 *Ibid.*, p. 128.

inhabitants of Europe.[1] This was not a novel opinion, as may be seen from the following quotation from Professor Boule's *Fossil Men*: "All this leads one to think that the two types, Cromagnon and Chancelade, do not differ greatly, an opinion, indeed, shared by many anthropologists. Dr. Testut, however, has brought out certain differences."[2] At the time at which I write (1930) most students of ancient man are convinced that the people who inhabited Europe in Magdalenian times were not members of the white race, but were closely akin to the Eskimo, and were therefore representatives of the yellow or Mongolian stock of mankind. Professor W. J. Sollas has unwaveringly advocated this view,[3] and when the last edition of this work appeared challenged my interpretation of the racial nature of Chancelade man.[4] Dr. G. M. Morant has measured the Chancelade skull and made an exact analysis of its measurements, and has come to the conclusion that "if we may ignore the uncertain measurements, then we cannot point to any single character among those selected for measurement which clearly distinguishes the Chancelade skull from the mean Eskimo type".[5] In brief, if Chancelade man were alive now and we had to place him in his racial group, we should assign him to the Eskimo. This is also the

1 At an earlier date Professor Le Gros Clark had published in the Journal of the *Royal Anthropological Instit.* (1920, vol. 50, p. 281) a study of "Ancient Eskimo Skulls". In the course of his inquiries he made a comparison of the Eskimo and Chancelade skulls and came to the conclusion that "there is no justification for the assertion that *l'homme de Chancelade* is a representative of an Eskimo population which lived in France during the late palaeolithic period".

2 *Fossil Men*, translated by J. E. and J. Ritchie, 1923, p. 294.

3 *Ancient Hunters and their Modern Representatives*, 3rd ed., 1924.

4 W. J. Sollas, "The Chancelade Skull", *Man*, 1925, vol. 25, p. 157. The author's reply appears in *Man*, 1925, vol. 25, p. 186. A further reply from Professor Sollas, *ibid.*, 1926, vol. 26, p. 68. Professor Sollas's full analysis of the Chancelade skull was published in the *Journ. Roy. Anthrop. Instit.*, 1927, vol. 57, p. 89. See also important articles on the cranial capacity of the Chancelade skull by Miss M. L. Tildesley, *Man*, 1926, vol. 26, p. 2, and by Professor Karl Pearson, *ibid.*, p. 46. They demonstrate that I have undervalued the cranial capacity of the Chancelade man; instead of being 1530 c.c., as I have stated, it is at least 1650 c.c.

5 Dr. G. M. Morant, "Studies of Paleolithic Man", *Annals of Eugenics*, 1926, vol. i, parts iii–iv (see also reference given on p. 390).

conclusion to which two other distinguished anthropologists have come: Dr. K. Saller[1] and Dr. Louis R. Sullivan.[2]

Before readers commit themselves to the theory that Europe was inhabited during Magdalenian times by Eskimo or a people of Mongolian stock, let them consider some of the difficulties which have to be faced by its acceptance. At the present time the eastern half of Asia is the chief homeland of peoples of the Mongolian stock; we have every reason to suppose that this stock became differentiated in Eastern Asia, north of the Himalayas. From its home in Asia the Mongolian stock has thrown out branches to the Arctic north, one passing eastwards to Greenland, the other westwards to Lapland in Northern Europe. The extreme eastern branch is represented by the Eskimo; every circumstance, if we accept the theory of evolution as our guide, points to the Eskimo as having become differentiated in the northern zone now occupied by this Mongolian race. Deployed along the other or western end of the circumpolar front, we find the Lapps, easily distinguished from the Eskimo and yet, like them, a branch which has certainly sprung from the great Mongolian stock. It is usually presumed that, as the edge of the ice sheet retreated northwards in Europe the Magdalenian hunters followed in its wake. If the reindeer-hunters of Europe had been Eskimo, then we should expect to find them where now the Lapps are and not at the opposite end of the Arctic front—in Greenland. If we accept the Eskimo theory, then we have to explain how a people could have trekked across the breadth of the Old World, from the Bay of Biscay to beyond Behring Straits, without mingling their blood with that of intermediate peoples.

If we reject the Eskimo theory, then we have still difficulties of another kind to face. How has it come about

[1] Dr. K. Saller, "Die Cromagnon rasse und ihre stellung zu anderen jung paleolithischen Langschaedel-rassen", *Zeitsch. für induktive abstammungslehre*, 1925, vol. 39, part 2.

[2] Dr. Louis R. Sullivan, "Relationships of the upper Palaeolithic Races of Europe", *Natural History*, 1924, vol. 24, p. 682.

that the living Eskimo reproduce in their mode of living a culture which is so similar to that of the Magdalenian Europeans? There is less difficulty in postulating a direct spread of culture; I have no doubt that a common source from which Magdalenian Europeans and modern Eskimo could have derived their modes of living will yet be revealed by archaeological discovery.

We who reject the Eskimo theory have also another difficulty to overcome—one of an anatomical nature. Several of the skulls of the Magdalenian Europeans show many and striking resemblances to those of Eskimo. The Chancelade skull in particular, and also that of the Obercassel man, are marked by many Eskimoid features—prominent cheek bones, wide zygomatic arches, besides many other points relating to the conformation of the head. We shall come back presently to a consideration of these likenesses in head form. Meantime let us consider the peculiarities of the Eskimo face; they are due to a retrocession in nose development—a Mongolian trait—and to a peculiar increase in jaws and other structures concerned in mastication. The conditions under which the Eskimo have lived have called forth their great and peculiar development of jaws, and seeing that the European Magdalenians lived under similar climatic and cultural conditions we may presume that their jaws became modified in a manner similar to that found in modern Eskimo. I look upon such resemblances as being of a functional nature and that they need not indicate any direct blood-relationship of the Magdalenian people of Europe to the Eskimo of Greenland.

In an introductory chapter[1] the problem of race identification has already been discussed. In the identification of the racial nature of the Chancelade man we find two methods are being applied—the biometrical and the anatomical. Dr. G. M. Morant,[2] applying the elaborate and exact processes of the biometrician, infers that Chancelade man was an Eskimo; anatomists, like LeGros Clark and myself, applying the ancient methods employed

[1] Page 30. [2] See reference, p. 390.

by zoologists in the recognition of species and varieties, have come to an opposite verdict. We are guided by anatomical characters; we can assess their value, for purposes of race identification, by the unaided eye. For example, if we are asked to determine whether a given skull is that of a New World or of an Old World monkey, we at once examine the teeth, the orbit and the ear, and therein find certain marks which guide us to the racial identity of the skull. Calipers could not help us. It is so with the identification of any given human skull; certain marks determine our verdict.

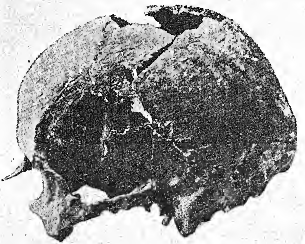


FIG. 125.—Reproduction of an early photograph of the Chancelade skull, showing the nasal bones in place.

Now there never was any Mongolian people had such a nose as marked the face of Chancelade man. The nasal bones were present when the Chancelade skull was found, but became broken off and lost. Fortunately a photograph of the skull in its original condition has been preserved [1]; it is reproduced in fig. 125; the nasal bones spring forward at an angle never seen in any Eskimo or Mongolian face but to be met with in Cromagnon skulls, especially in that of the "old man" and also in many modern Europeans. The Chancelade man, in spite of his Eskimoid

[1] E. T. Hamy, "Nouveaux matériaux pour servir de la Paléontologie humaine", *Congrès Internat. d'Anthrop.*, Paris, 1889, pl. iii.

resemblances, is really a representative of the European or white stock.

When we survey the small group of European Magdalenians known to us, we are driven to the conclusion that they are of the same stock as the Predmostians and Cromagnons of the Aurignacian period. In the passage from the one period to the other there was a great change

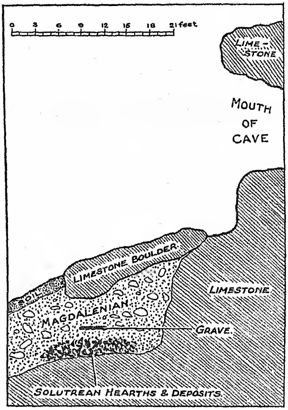


FIG. 126.—Section of the rock-shelter on the north side of the Valley of the Roc. The position of the Magdalenian remains is shown.

in climatic conditions, and this change may have had a selective effect on the Aurignacian peoples of Europe and thus modified the strains which survived. The Cromagnons were big brained, big jawed and tall. Tallness disappears in the Magdalenian period; the jaws, still big, become altered in certain of the men, as exemplified in the Chancelade and Obercassel men. In other men, as we shall see, the earlier jaw and face formation was retained. But the women did not share in these changes;

they retained the features and head form of the Cromagnon and Predmost women who, in the majority of cases, conformed to what may be described as the Combe Capelle type.

Let us touch briefly on the Magdalenians which Dr. Henri Martin unearthed in the Valley of the Roc and described in 1927.[1] Some eleven miles to the south-west of Angoulême (fig. 115), the chief town of Charente, a narrow steep-sided valley cuts across the limestone plateaux from east to west. Along it runs a small stream, the Roc, emptying its waters into the l'Échelle, which in turn joins the Charente. The Magdalenians occupied certain caves and shelters along the northern side of the valley. Dr. Henri Martin was so fortunate as to find one of their graves, one in which three bodies had been laid—a man, a woman and a youth. In fig. 126 is reproduced Dr. Martin's sections of the deposits in which the skeletons were discovered.

Fig. 126 shows a section of the northern side of the Valley of the Roc. Near the top of the cliff opens a cave; on the declivity below the mouth of the cave there is a heap of massive blocks of fallen limestone. Dr. Martin's excavations show that the fallen rocks had provided a shelter for the people who occupied the valley in Solutrean times. Along the sloping floor of the rock-shelter is a deep deposit containing the hearths and implements of the Solutreans. Over the Solutrean stratum came deposits containing implements and various objects of an early Magdalenian date, with remains of the reindeer and of other contemporary animals. It was in this Magdalenian deposit just over the Solutrean hearths, and under a massive rock which had formed a roof for the shelter (fig. 126), that Dr. Martin found remains of three human beings—all of them much crushed. The discoverer was able to partially restore the skulls of the two adults and identify one as being that of a man, the other of a woman, but as the sex markings are not at all pronounced there is room for a difference of opinion. Indeed, from an inspec-

[1] See references, p. 390.

tion of the drawings of the skulls, I think that both are women's skulls. It is therefore better to speak of them as "A" (Dr. Martin's male) and "B" (his female) skull. In fig. 127 is reproduced Dr. Martin's drawing of the "B" (woman's) skull. It fits very comfortably within the conventional framework of lines employed in this work for European skulls of moderate dimensions. The maxi-

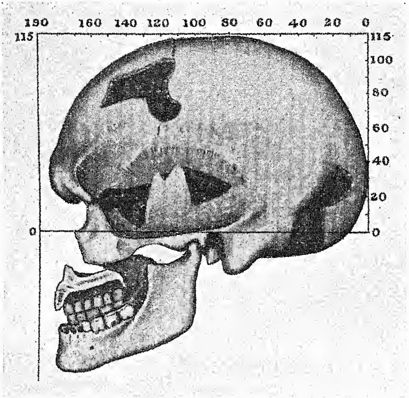


Fig. 127.—Profile of skull "B" found by Dr. Martin in a Magdalenian deposit in the Valley of the Roc.

mum length of the skull is 185 mm., its width 140 mm., the width being a little over 75 per cent. of the length, the skull thus lying at the upper limits of dolichocephaly. The vault of the skull rises 114 mm. above the ear-holes. Skull "A" has very similar dimensions, being a little longer (187 mm.), a little narrower (137 mm.) and a little higher (116 mm.). In neither skull was it possible to make a direct estimate of brain capacity, but from the measurements given one estimates that in each case the capacity

was about, or a little over, 1400 c.c., quite considerable amounts if one accepts both skulls as being those of women.[1]

Unfortunately the facial parts of both skulls are ill-preserved, but from the features which can be made out one infers that the faces of these Roc Magdalenians resembled those of Cromagnon women—all save in one very important respect. There are two reliable guides to the development of the masticatory system—the area of the dental palate and the width of the ascending ramus of the lower jaw. The ramus in the two Roc skulls are reduced in development to a degree met with in modern Europeans living under civilized conditions. In skull "B" (fig. 127) the width of the ascending ramus is 33·5 mm.—10 mm. less than in the Chancelade skull; in skull "A" (Dr. Martin's male) the ramal width is only 27 mm. Such a retrocession is a very surprising condition to find in the jaws of people living under Arctic conditions, so unlike the robust jaw development found in the Chancelade, Obercassel and Eskimo skulls.

If we take all points into consideration—the size and shape of the skull, the dimensions and form of the face —we may regard the Roc people as conforming to the female Cromagnon type. Dr. Martin, however, regards them as members of the Chancelade race. It will repay us to consider his chief reason for coming to this conclusion. In fig. 128 I reproduce Dr. Martin's drawing of the Roc skull "B" (woman's) and beside it Professor Testut's drawing of the Chancelade man's skull—both being reduced to the same scale. Both skulls are approximately of the same width, but the roof of the Chancelade skull is the loftier; in the Roc skull the vault rises 114 mm. above the level of the ear passages, whereas in the

[1] Dr. Martin gives the capacity of the "A" (man's) skull as 1525 c.c. and 1350 c.c. as that of the woman's. The "A" skull is the smaller in all its width dimensions, its minimal frontal being only 90 mm., its maximal frontal 106 mm. —very low measurements, whereas in the "B" (woman's) skull the corresponding figures are 96 mm., 127 mm. It is also a very puzzling circumstance that the bizygomatic width of the "A" (male) skull is given as 119 mm. and that of "B" (female) as 140 mm.

Chancelade skull it rises 124 mm. There is a similarity in their outlines; both are flat-sided and in both the vault rises up to form a ridge or keel. We notice an important difference in the flattening of the sides; in the Roc skull the greatest width is high up, nearly opposite the parietal eminences, whereas in the Chancelade skull the greatest width is at or just above the level of the ear passages. Now this difference in width diameters may be due to age or to sex. In youth the skull is wide above and narrow below, but at adolescence, particularly in men and especi-

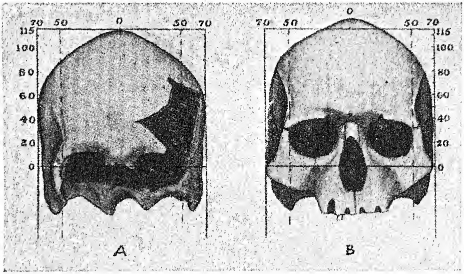


FIG. 128.—A. Face view of the Roc skull (woman's) compared with B, a similar view of the Chancelade skull given by Professor Testut.

ally in strong, thick-necked, big-jawed men, the basal parts of the skull expand and become wider than the upper or parietal parts. Women usually retain the narrow base of youth—a reason for regarding the Roc skulls as female. Now this basal expansion of the skull is more common among Eskimo than in any race known to us, but it is also common in many long-headed races, such as the Australian aborigines, and is by no means rare among dolichocephalic Europeans. The Chancelade skull has in its relatively wide base, flat, hollow sides, an Eskimoid character, but of the fifteen adult Magdalenian Europeans known to us it stands almost alone. The Langwith

skull most resembles it in these points, but no more than do many skulls belonging to diverse races of mankind.

Often associated with the Eskimoid flattening of the sides of the skull, there is another remarkable character, the keeling or ridging of the vault. This is particularly well seen in the Chancelade skull. It is present in most Eskimo skulls; it is prevalent in the skulls of many primitive peoples, such as the aborigines of Australia; it occurs in several Cromagnon and Predmost skulls; it is not uncommon in Europeans—as one may observe in older men who have gone bald along the crown of the head. In such men we can see a ridge-like elevation begin in the middle line of the crown, between or above the eminences of the forehead, and, passing backwards, become expanded in width and prominence as it reaches the bregma. As it passes backwards on the crown the eminence forks and then runs along each side of the sagittal suture to fade away before the hinder end of that suture is reached. Of late years I have been investigating the cause of this calvarial keeling, and find it is due to certain physiological processes which go on within the living skull. We now know, thanks to the labours of Cushing, Weed and others,[1] that there is a circulation of fluid within the skull, connected with the upkeep of the brain—the cerebro-spinal fluid, which bathes the brain and all parts of the central nervous system. The fluid is formed at the base of the brain; it is absorbed from cisterns under the roof. The fluid flows from the base to the roof along certain stream lines.[2] The keeling or elevation which we see passing along the crowns of certain long-headed individuals marks one of these stream lines. Why this keeling should be so often pronounced in people with narrow, long, flat-sided skulls we do not know, but since the condition is functional in nature and is found in diverse races of mankind, it is not one to be assessed highly when we come to decide the racial affinities of prehistoric men.

[1] See references, p. 471. [2] For further details, see Chapter XXXI, p. 469.

Let me now pass in very brief review some of the other finds of Magdalenian Europeans. The skull unearthed in the cave at Placard, a Magdalenian station in the same department as Roc, agrees very well with those described by Dr. Martin. It was shorter, namely 175 mm., of like width (140 mm.), and although falling within the brachycephalic category, yet shows so many points in common with skulls just described that we may

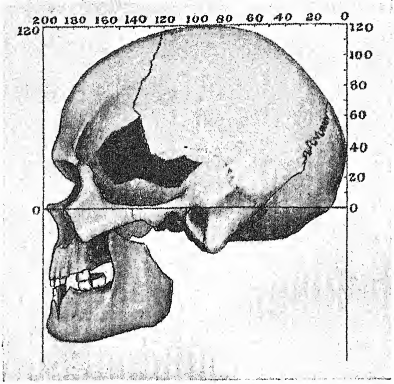


Fig. 129.—Profile of the Laugerie-Basse man's skull. (After Hamy.)

accept it as of the same race as the Roc people. The skull from Sorde (see fig. 115) was regarded by M. Hamy as being of the Cromagnon type. Its dimensions are similar to those of the Roc skulls. So is the Magdalenian skull from Bruniquel. The child's skull from Genière in the Ain may well be a young stage of the Cromagnon type; although only 8 years of age, the ascending ramus of its lower jaw has a width of 30 mm. Perhaps the most important find of Magdalenians in our list is that made in the cave at Laugerie-Basse so long ago as 1872. In

fig. 129 is produced M. Hamy's profile of the skull of the Laugerie-Basse man, No. 4. He lay at a depth of 13 feet within a deposit of Magdalenian age. In all his cranial characters he was of the accepted Cromagnon type. The skull was 194 mm. long, 146 mm. wide; the vault rose 122 mm. above the Frankfort plane. His supra-orbital ridges, like those of the Chancelade man, were of the pronounced form common in male Cromagnon skulls, and were 111 mm. in width. His face, in its dimensions and conformation, was such as we see in the Cromagnon men found in the caves at Mentone. His jaws were strong, the width of the ascending ramus of the jaw being 40 mm. He had a moderately developed ridge along the cranial vault. The woman whose remains lay in the same deposit was, like Cromagnon women in general, of a much smaller build. In dimensions and shape her skull resembled the skulls found at Roc; the greatest length of her skull was 179 mm., its width 134 mm., but it was wide across the supra-orbital ridges, 106 mm.

A survey of all the evidence at present at our disposal leads me to the conclusion that the people who inhabited Europe in the closing severe phase of the last glacial period—the Magdalenian Europeans—were the descendants of the older inhabitants, the kind of people found in the Aurignacian deposits of Southern France and of Moravia. If they were new arrivals, then they were emigrants from the same stock as gave Europe her Aurignacian inhabitants. The severe climatic conditions of Magdalenian times probably did bring about a change in the population—and a sparse population it must have been—by selective action and other more direct influences. Certainly the Chancelade man is not representative of his day and generation; he was apparently the exceptional individual to be found in every community of human beings. Further, in the full sense of the term, the Magdalenians were Europeans; in their physical characters they bear the essential marks of the Caucasian stock of mankind.

Our knowledge of the inhabitants of Europe during the period of Magdalenian culture remains very imperfect; still more scanty is it concerning the people who followed them, the people of the Azilian culture. Since I made my last survey in 1925,[1] only one important addition has been made to our knowledge of the Azilian population of Europe. The discovery was made in a cave (Trou Violet) at Montardit in the department of Ariège, at the base of the French Pyrenees, near the village of

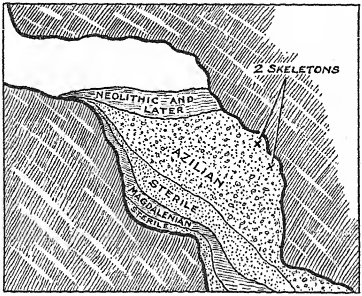


FIG. 130.—A section of the strata found in the floor of Trou Violet. The position of the human remains in the Azilian stratum is shown. (After Vaillant Couturier.)

Montardit (fig. 115, p. 353) and not far from the famous Azilian station Mas d'Azil.[2] Remains of two individuals were found, representing the burials of a youth and of an adult—probably a male. The remains lay at a depth of 7 feet (fig. 130); the archaeological evidence leaves no doubt as to the Azilian age of the burials. The adult skull, probably that of a man—but the sex markings are not pronounced—is of small size, its length being 180 mm., its width 136 mm., the width being just over 75 per

[1] See *Antiquity of Man*, vol. i, p. 109. See also chart, p. 464.

[2] Ida Vaillant-Couturier, "La Grotte Azilienne du Trou Violet à Montardit Ariège", *L'Anthropologie*, 1928, vol. 38, p. 217.

cent. of the length. His cranial capacity is stated to have been 1389 c.c.; his femur was only 407 mm. long, so that his stature must have been under 5 ft. 2 in. In its dimensions, in its shape and in the characters of its face and jaws this Azilian skull bears so close a resemblance to the smaller Magdalenian skulls found in the south-western departments of France that I think we must assign all to the same race. The Azilians in Southern France may well have been the direct descendants of the indigenous Magdalenian population.

In *Antiquity of Man*[1] there is described a people—whose remains were discovered in Aurignacian deposits at Solutré—which display a marked tendency to brachycephaly; their skulls are relatively short and wide, although they do not differ in shape and dimensions of face from the longer and more massive-headed Cromagnon people. This Solutrean type gives us the earliest traces of brachycephaly in Europe. In Azilian times a round-headed, short-statured type lived at Ofnet[2] in Germany. The type, as we shall see, reached England.[3]

We thus bring to a close our survey of the people who lived in Europe during four successive long periods of culture—Aurignacian, Solutrean, Magdalenian and Azilian, which, on the moderate reckoning used in this work, cover a period of some 12,000 years. We begin with robustly built, big-brained, strong-jawed men. Some, like the Cromagnon men of France, were of great stature. We end in Azilian times with people of small stature, with brains of moderate size and with reduced development of jaw and tooth. Yet, different as the Azilians are from the Aurignacians, I am not convinced that the differences are due to the introduction of new races. Throughout the later palaeolithic periods the inhabitants of Europe belong to the same great stock of humanity, the white or Caucasian division of mankind. The climate of Europe underwent marked changes, and it is possible that these brought about directly or indirectly physical transformation of her population. On the other hand, the older

[1] Vol. i, p. 101. [2] *Ibid.*, p. 109. [3] See p. 407.

stocks may have died out and been replaced by invading peoples, but if such has been the case, then the new peoples, with perhaps the exception of the brachycephalic Aurignacians and Azilians, must have come from the same homeland as gave Europe her early long-headed inhabitants.

CHAPTER XXVII

THE LATE CAVE MEN OF ENGLAND

In the previous chapter we have been tracing the late cave-dwellers on the continent of Europe through the rigours of the final phase of the last ice age and have taken our leave of them just as our more temperate climate was at its dawn. We are now to cross into England to see what progress has been made in unravelling the history of her inhabitants at a corresponding period. When preparing the second edition of *Antiquity of Man* in 1925 I was able to include an important discovery made by the members of the Spelaeological Society of Bristol University.[1] In exploring late pleistocene caves in the Mendips (fig. 131), they discovered in Aveline's Hole the fossil bones of the people who lived in the south-western part of England just after the ice age had passed away. The reindeer and other Arctic animals still lingered on; they hunted successfully a large form of red deer. Their culture was that of a transitional kind—usually spoken of as Azilio-Tardenoisean. These early English people were remarkable in several respects; they were of small stature, and of the three human skulls which had been discovered in Aveline's Hole, two fell into the round category, their width being 80 per cent of their length. This was the earliest evidence of a brachycephalic people in England, whom we suppose to have lived about 8000 or 10,000 years before our era. The discovery was of particular interest because of one made on the northern frontier of Bavaria, just within the watershed of the Upper Danube,[2] in the Ofnet cave. This cave, which lies over 600 miles from Aveline's Hole as the crow flies, contained in its upper strata the same stone and bone cultures as the cave in the Mendips. Now the Ofnet people resembled those of the Mendips in many respects; in both we find long-headed and short-headed individuals —only the Ofnet short heads show a greater degree of

[1] See *Antiquity of Man*, p. 138, 3rd edition. [2] *Ibid.*, vol. i, p. 109.

roundness. In both communities faces were short, relatively wide and flat, their noses being also short and not prominent. The resemblances in physical form and in culture between these two communities are so numerous that we must suppose there had been a westward migration of the Ofnet people and of their culture. Further, it is probable that Ofnet people had come originally from Western Asia, for all evidence points

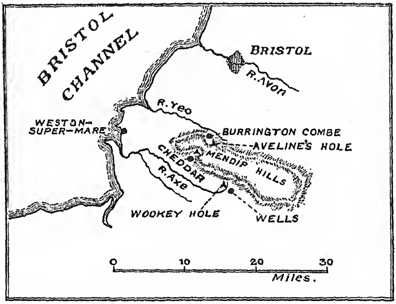


Fig. 131.—Sketch map of the Mendips, showing position of Aveline's Hole and Cheddar cave.

to that part of the world as the cradle land of round-headedness.

In Belgium, which lies on the road to England, the same culture and the same people are represented in the upper strata of some caves. So long ago as 1867 Eduard Dupont, on exploring the caves along the lower valley of the Lesse—just before that stream joins the Meuse above Dinant—found in the "reindeer" strata at Furfooz skulls of this same brachycephalic people.[1] Less than 100 miles to the south of Furfooz is Fère-en-Tardenois, on the Ourcq, which provided the type culture—the Tardenoisean—the handiwork, as we may

[1] See *Crania Ethnica*, by Quatrefages and Hamy (1882).

suppose, of this round-headed people. Quatrefages recognized the "Furfooz" type amongst the skulls found in palaeolithic strata at Solutré, right in the heart of France, but we now know that these Solutreans were tall and represent a still earlier wave of brachycephalism, one which falls within the period of Aurignacian culture.[1] At Mugem, in Portugal, we again meet with the Furfooz and Ofnet types of people, accompanied by a culture which links these early Portuguese to the late palaeolithic people of Bavaria, Belgium and England.

Thus when preparing a new edition of this work in 1925 there was evidence which led me to believe that the round heads, which spread westwards in Europe as the ice-sheet retreated towards its present limits, had reached England, and that even as early as Azilian times England was being invaded, across a land connection, from Central and Western Europe. I have therefore followed with particular interest all cave explorations which have been made in England in recent years to see if any further evidence would come to light of a post-glacial invasion of England by a round-headed people of small stature. Additional discoveries were made in the long recess of Aveline's Hole, not far from where other fossil remains of the cave men had already been found.[2] Three further burials were found in the cave-earth, under conditions which leave no doubt as to their period, that of the Azilio-Tardenoisean culture, but in only one was the skull sufficiently preserved for measurement. The position of the burial which provided the intact skull is shown in fig. 132; a mass of rock had fallen from the roof and crushed many of the bones. Amongst the human bones were teeth of the giant red deer, of a small deer, of the brown bear, the astragalus of a horse, fragments of antlers, jaws of the lemming, split animal bones and numerous flints as well as other objects of the period. A slab of red sandstone had been placed over the burial.

[1] See *Antiquity of Man*, vol. i, p. 92.

[2] "Fourth Report on Aveline's Hole, by J. A. Davies", *Proc. Spelaeolog. Soc.*, 1924, vol. 2, p. 104.

The human bones lay below the level of an ancient hearth. The skull from this grave is of the long type, not unlike that already depicted.[1] Early in the nineteenth century Dean Buckland had visited Aveline's Hole and carried back with him to Oxford University a human skull, to which a stalagmitic covering still clings. This is also of the long type, as Dr. L. H. Dudley Buxton has shown.[2] The Oxford skull, that of a man, is 188 mm. long, 134 mm. wide, the vault rising 116 mm. above the ear-

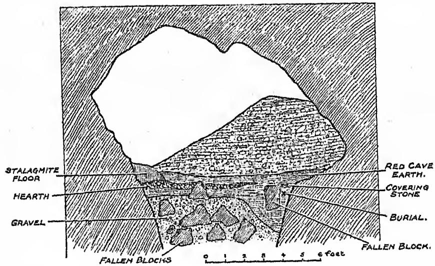


FIG. 132.—A section across the recess of Aveline's Hole to show a section of the strata of the floor, the site of an ancient hearth and the position of the burial.

holes. The width of the skull is 71 per cent. of the length. Several additional lower jaws from the cave-earth have been described by Professor E. Fawcett.[3] Thus of the five skulls from Aveline's Hole three are of the long form, two of the round, but all have the same lofty vault and have so many resemblances to each other that I look on them as variants of the same racial series. Yet there is no doubt that the tendency to short-headedness or to brachycephalism in this palaeolithic community must be ascribed to a mixed lineage, one into which a brachycephalic ancestry had entered. A similar mixture of "longs" and "rounds" is represented at Ofnet.

[1] See *Antiquity of Man*, vol. i, p. 141, fig. 51.
[2] *Proc. Spelaeolog. Soc.*, 1924, vol. 2, p. 115.
[3] *Ibid.*, p. 120.

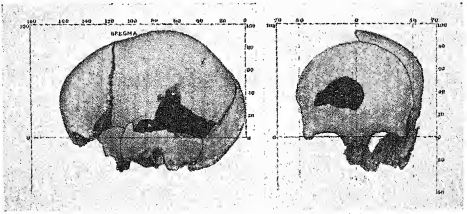
To eke out our knowledge of Englishmen of the late palaeolithic period—a period covered by the northern retreat of the ice-sheet—we shall now visit Gough's cave, Cheddar, situated in the southern flank of the Mendips only three miles from Aveline's Hole (fig. 131). A study of the cultural objects and fossil animal bones from this cave has led Mr. J. A. Davies to the conclusion that the period of occupation of Gough's cave is nearly the same as that of Aveline's Hole. The deeper deposits of Gough's cave, however, carry history rather farther into the past, for in its cave-earth were found two of those puzzling objects, worked out of the antlers of deer, known as *bâton de commandement* or arrow-straighteners. Artefacts of this kind were made by the Frenchmen of the Magdalenian period and are still fashioned by Eskimo. The upper strata in Gough's cave contain the same culture as prevails in Aveline's Hole, so we may expect to find the same community represented at both places, seeing how near they are to each other in time and place.

The famous "Cheddar man" was found in 1903, when Mr. Gough made a new entrance to his cave.[1] A trench was dug in the strata of the floor to a depth of 4 ft. 6 in., a skeleton being found in the cave-earth just under the stalagmite. The cave-earth on each side of this trench was left untouched until 1928, when it was resolved to enlarge the entrance by removing the strata which lay on either side of the original trench. Layer after layer was removed in a systematic manner until rock-bottom was touched at a depth of 8 feet 6 in. Every spadeful was examined, and the position of every object recorded by Mr. R. F. Parry.[2] Under the stalagmite stratum came a deposit of red cave-earth 2½ feet in depth; then a layer, 5½ feet in thickness, made up of bedded red cave-earth, loams and sands; the bottom stratum was made up of gravel and of sand. At a depth of 6 feet, embedded in

[1] The discovery and characters of the Cheddar man are given in *Antiquity of Man*, vol. i, p. 136.

[2] *Nature*, 1928, vol. 122, p. 735. See also an account by Mr. J. A Davies, *The Times*, August 6, 1928.

the cave-earth, human remains were found, belonging to at least five individuals. A man, over 35 years of age, was represented by only a fragment of an upper jaw; several separate bones were assignable to two children about 12 or 14 years of age. The two other specimens are more helpful for our present purpose; one is the calvaria of a young man under 25 years of age; the other is an imperfect skull of a child about 3 years of age. Thus we have the remains of three individuals to provide us with a



(A) (B)

FIG. 133.—Profile (A) and full face (B) of the child's skull from Gough's cave, Cheddar.

knowledge of the kind of people who lived at Cheddar some 10,000 years ago or more.

Let us take the skull of the 3-year-old child first; it is represented in fig. 133, A, B. The profile shows how prominent the upper part of the forehead was and how steeply the vault rises behind the bregma (fig. 133, A). We have in these features repetitions of those seen in the brachycephalic skulls from Aveline's Hole.[1] And yet the Cheddar skull—almost certainly that of a girl—is not technically a round skull. Its length from the glabella, above the root of the nose, to the occiput, is only 157 mm.; it is 8 mm. more if we take the length from the upper part of the forehead. It is a narrow skull; its greatest width, which is high up on its sides—as is usual in childhood—is only 118 mm., being 75 per cent. of the glabello-

[1] See *Antiquity of Man*, vol. i, p. 142, fig. 52.

occipital length, but only 71 per cent. of the greatest length. In head form the child belonged to the long-headed group. The vault of the skull was relatively high,

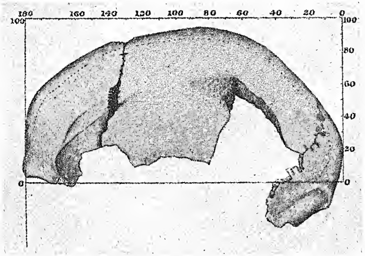


Fig. 134A.—Profile of Cheddar skull (No. 2).

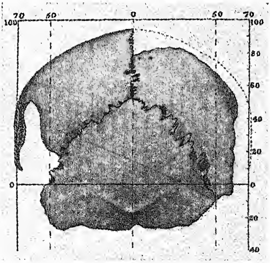


Fig. 134B.—Cheddar skull (No. 2) oriented on subcerebral plane and shown from behind.

rising 107 mm. above the Frankfort plane and 94 mm. above the subcerebral plane. Save for its state of fossilization, there is no feature or combination of features in this skull that is not to be found amongst modern children in the south-west of England.

The skull of the young man, depicted in fig. 134, had been much broken soon after burial, for the fractured surfaces are coated with a stalagmitic deposit. The glabella has been broken away, but it is evident that the supra-orbital ridges had been strongly developed, just as in the original Cheddar man (No. 1). In length this skull is 192 mm., nearly equal to that of the original skull, and it exceeds it in width—being 144 mm. wide—against 138 mm. in the original. In Cheddar man No. 1 the width proportion is 70·4, whereas in No. 2 it is 75, falling just within the "long" category. This skull, however, differs from the original in height of vault; it rises only 95 mm. above the subcerebral plane, whereas in the original the vault height is 105 mm. In thickness of vault both skulls are alike varying from 4 to 7 mm.; in capacity No. 2 is slightly smaller, its estimated measurement being 1425 c.c. Thus the cave-dwellers at Cheddar are all, so far as we know them, of the long-headed type. We have met with no other representative of the short-headed type, save these two from Aveline's Hole. In Gough's cave some of the human bones had been fractured when still in a fresh condition, but none shows distinct signs of wilful cleavage.

The Azilio-Tardenoisean culture represented in the caves of the Mendips occurs also in the most extensive and most important of all British caves, Kent's Cavern,[1] situated in a limestone hill behind Torquay, 70 miles distant from the Mendips. Let me remind my readers of the principal strata in the floor of Kent's Cavern, in order that they may grasp the significance of recent discoveries made in them (fig. 135). There is the upper or first layer of stalagmite, covered by deposits of the neolithic and more recent periods. Then comes (2) a deposit of red cave-earth which varies much in depth from part to part of the vast cave; (3) the lower stalagmite; (4) a deep dense calcareous conglomerate or breccia. Now the deposition of these four strata covers a long period of time, almost equal to the duration of the pleistocene

[1] See *Antiquity of Man*, vol. i, p. 145.

period (see fig. 162, p. 464). When the breccia was laid down human beings lived in this part of England and fashioned their stone implements in the Chellean and later in the Acheulean style,[1] for such implements—sparsely, it is true—occur in the breccia. The upper three

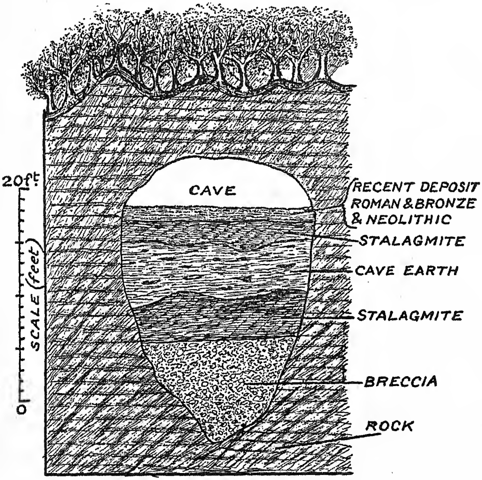


FIG. 135.—The chief strata which make up the deposits in Kent's Cavern, Torquay.

strata appear to mark phases of the last ice age—the lower stalagmite being formed in the first severe phase—when Neanderthal man was still alive; the upper stalagmite marks its culminating severity, and the cave-earth its intermediate or Aurignacian phase. In spite of much

[1] For a more exact and detailed analysis of the distribution of cultures in the strata of Kent's Cavern, see an article by Mr. Harford J. Lowe, *Trans. Torquay Nat. Hist. Soc.*, 1926, vol. 4, p. 295. Mr. Lowe places the Mousterian culture *above* the lower stalagmite.

search the only part of man's body discovered down to 1927 was part of a human palate; this was found in the upper stalagmite by Mr. Wm. Pengelly in 1867.[1]

In 1925 a committee was formed to excavate unexplored parts of the cave. A trench was dug right across the vestibule (fig. 137) to a depth of 23 feet. In the cave-earth throughout this depth were found fossil bones and teeth of the mammoth, woolly rhinoceros, cave bear, horse, hyaena, red deer and reindeer; the implements were fashioned in the upper or later Aurignacian manner.[2]

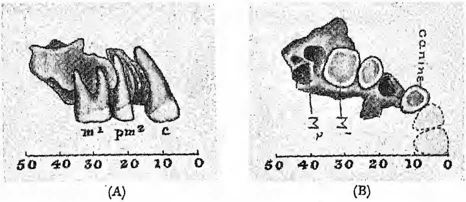


FIG. 136—Fragment of a human upper jaw with three teeth, found in the cave-earth of Kent's Cavern at a depth of 10½ feet; (A) from the side, (B) from below

In the cave-earth at a depth of 10½ feet was found a fragment of an upper jaw with three teeth of the right side still in place—the canine, second premolar and first molar (fig. 136). The sockets for the first premolar and second molar are also preserved. Now, although found so deep in the cave-earth, the teeth of this jaw, in size and in conformation, are similar to those of the palate found by Mr. Pengelly in the upper stalagmite. The teeth differ from those of a modern Englishman only in their degree of wear and freedom from disease. The crown of the first molar is worn flat and smooth, so that the dentine is exposed within a rim of enamel.[3] The crowns of the

[1] See *Antiquity of Man*, vol. i, p. 147.
[2] H. G. Dowie, *Proc. Prehist. Soc. of East Anglia*, 1927, vol. v, p. 306; *Reports of British Association*, Leeds, 1927, section H.
[3] For description of this specimen, see Keith, *Trans. Torquay Nat. Hist. Soc.*, 1927, vol. v, p. 1.

pre-molar and canine are also worn flat. The crown of the first molar tooth measures from front to back 10 mm., from side to side 11·6 mm. The total length of the tooth, from crown to tip of roots, is 16 mm., the roots making up 12 mm. of this amount. If we measure from the front surface of the crown of the canine to the hinder border of the molar tooth, the distance is 13 mm., just such an amount as we expect to find in a modern European.

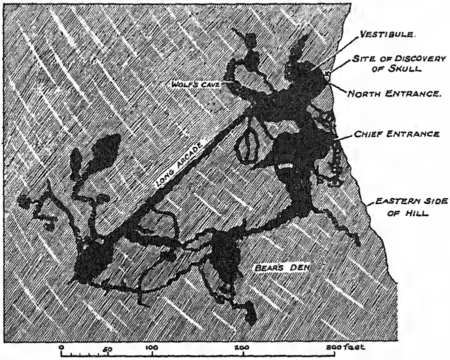


FIG. 137.—A ground plan (black) of Kent's Cavern, showing the position of entrances and vestibule.

There cannot be any doubt, on the evidence afforded by this specimen, that the men who frequented Kent's Cavern when the cave-earth was being laid down were of the modern or neanthropic type and that the same type persisted in this part of England until the upper stalagmite of Kent's Cavern came to be formed.

In the autumn of 1925 an undesigned excavation brought to light at Kent's Cavern what deliberate exploration had failed to discover, a human skull sufficiently complete to indicate the racial nature of the later cave

men. Mr. Powe, the owner of the cave, in order to extend his garden, dug into the base of the limestone cliff, near to the north entrance to the cave (see fig. 137). As he dug into the limestone debris at the base, he exposed fragments of a human skull. These fragments, which had the colour and consistency which characterize bones found in the cave-earth within the cave, when put together in the Museum of the Royal College of Surgeons, gave us

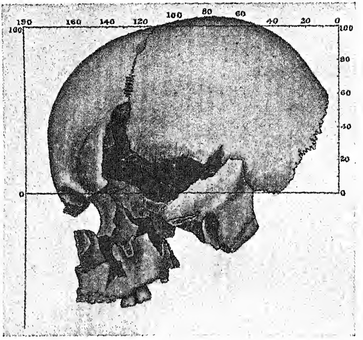


FIG. 138A.—Profile of the Kent's Cavern skull, placed on the subcerebral plane.

the skull represented in fig. 138. No implement, no animal bone, no hearth were found in the deposit at the cliff-foot; we have only the position in which the fragments were found and the condition of the bones to guide us to the antiquity of the skull. The teeth were embedded in a stalagmite covering. The skull reproduces all the features seen in the brachycephalic specimens which were found in Aveline's Hole. In the upper stalagmite of Kent's Cavern the same culture is found as at Aveline's Hole. These afford good grounds for presuming that the skull thus found at Kent's Cavern is that of an early post-

glacial Englishwoman, for the skull has female characteristics. She was young, under 25 years of age, for all the sutures of the skull are freely open; her bones were of moderate thickness, those of the vault varying from 5 to 7 mm. She was short-headed, the total length from glabella to occiput, allowing 8 mm. for the missing occipital bone, was only 175 mm. She was wide-headed, the maximum breadth being 143 mm., 81·7 per cent.

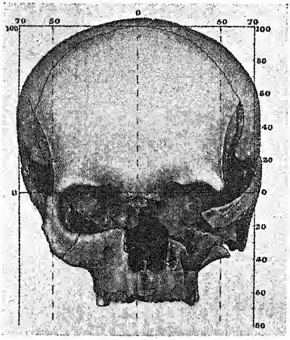


FIG. 138B.—Profile of the Kent's Cavern skull. Front view of the skull on the same plane.

of the length. She was distinctly brachycephalic, more so than the people of Aveline's Hole. She had the same lofty vault as the Aveline people, the highest point of the vault rising 120 mm. above the ear-holes. She had, like them, a prominent upper forehead. She was not of a primitive type, but retained to a high degree the characteristics of childhood seen so well in the child's skull from the Cheddar cave (fig. 133). Her cranial capacity is estimated to have been about 1400 c.c., well above the average for modern Englishwomen. Her face was particularly short, measuring only 60 mm. from root of

nose (nasion) to the alveolar margin. Nor was it wide—the zygomatic width being under 125 mm. The nose was short—only 44 mm., and of moderate width, 24 mm. The nasal sill was sharply delineated and the nasal bones flat and wide (13 mm. at the root). The upper jaw and palate were well developed, the length of the dental palate being 51 mm. and its width 64 mm.[1] The picture we have is that of a woman, probably of small stature, with wide and prominent forehead, drawn in and flattened at the root of the nose, small faced, with short, flat snub child-like nose and with no trace of prognathism or of lateral prominence of cheek arches. She was of the Furfooz type. Thus at Kent's Cavern additional evidence has come to light of the spread of this type into England when the rigours of the glacial age were vanishing. We may presume, too, that the Azilio-Tardenoisean culture was carried into England by this invading race.

Here, too, is the proper place to draw attention to a change which has come over the outlook of British archaeologists regarding the upper palaeolithic cultures represented in the caves of England.[2] The more exact methods which have been applied to the excavation of the caves in the Mendips, to Kent's Cavern, to the pleistocene deposits of East Anglia, and particularly to the caves of Cresswell Crags, Derbyshire, by Mr. Leslie Armstrong,[3] have brought about the realization that the sequence of cultures in Britain is not quite the same as in the caves of Central France. There have been local developments. In the French caves there is usually a clear sequence of cultures—Aurignacian, Solutrean, Magdalenian and Azilian, whereas in English caves the Aurignacian culture was only slightly affected by Solutrean and Magdalenian influences and continued until it faded into the final Azilio-Tardenoisean culture, characterized by very small

[1] For full description of this skull, see Keith, *Trans. Torquay Nat. Hist. Soc.*, 1926, vol. iv, p. 289.

[2] See M. C. Burkitt, *Our Early Ancestors*, 1926; Miss D. A. E Garrod, *The Upper Palaeolithic Age of Britain*, 1926.

[3] A. Leslie Armstrong, "Excavations at Mother Grundy's Parlour, Cresswell Crags, Derbyshire", *Journ. Roy. Anthrop. Instit.*, 1925, vol. 55, p. 146.

(pygmy) flint blades shaped in geometrical patterns. In one cave at Cresswell Crags Mr. Armstrong found deposits bearing the same culture as at Aveline's Hole. He also learned that a brachycephalic skull had been found in these deposits by an earlier excavator—presumptive evidence that the Furfooz type had spread into the midlands as well as into the southern parts of England.

CHAPTER XXVIII

THE EARLIEST KNOWN INHABITANTS OF SCOTLAND AND IRELAND

About the same time as men were living in the caves of the Mendips and of Cresswell Crags, Scotland was emerging from the long winter of the last ice age. Her shores and lowlands were becoming uncovered, and a people carrying a culture near akin to that of the later cave men of Southern and Central England were making their way across the north of England and along the west of Scotland. Traces of their culture have been found abundantly in these parts[1]; they were fishers, and fashioned a barbed harpoon out of bone, so we may speak of them as the "harpoon" people. Their culture is that of Maglemose, a late stone-age Baltic station, situated on the west coast of the island of Zeeland, Denmark. They arrived when England was widely connected with Germany by land now covered by the North Sea.[2] The harpoon people have been followed up the west coast of Scotland as far as Oban and the small island of Oronsay, but no trace of their bodily remains have been found, with the doubtful exception of a human skull obtained from McArthur cave, Oban.[3]

Since 1925 a most unexpected discovery has been made in the western part of Sutherlandshire, opposite the northern half of the Island of Lewis. If readers will consult a map of Scotland they will find that Loch Assynt, 10 miles inland, has at its eastern end a place named Inchnadampf. Near it, on the northern side of the loch, is a limestone formation rising into a hill situated more than 1000 feet above sea-level, and 200 feet above the bottom of the adjacent valley. Opening on the side of this hill is a series of caves. One of these was explored in 1889 by two expert geologists, Dr. J. Horne and Dr. B. N. Peach.[4] In the deposits of its floor they found six

[1] See *Antiquity of Man*, vol. i, p. 111.
[2] *Ibid.*, p. 43, fig. 15.
[3] *Ibid.*, p. 112.
[4] *Proc. Roy. Soc. Edin.*, Feb. 19, 1917.

strata; in two of these, the 3rd and 5th, the surface stratum being the 1st, they found the fossil bones of an Arctic fauna—lemming, northern vole, brown bear, reindeer, red deer and northern lynx. In the upper strata, made up of red cave-earth, were found traces of hearths, but of the men who had sat round them not a bone or implement.

Now it was known that at some remission of the last ice age the mammoth, woolly rhinoceros and reindeer had been able to find a sustenance in the south of Scotland, for their fossil bones have been discovered under the deposits of its final exacerbation.[1] If intraglacial man had followed these animals northwards we could hardly expect to find his remains after they had been pulverized under a moving field of ice, unless sheltered securely within a deep-set cave. In Cresswell Crags, and the same is true of the Vale of Clywd in North Wales, there are caves which have preserved intact fossiliferous deposits laid down during the last ice age and also during the preceding long temperate interglacial period. Might not a happy chance have preserved corresponding records in Scotland? It was this thought which led to the further exploration of the Inchnadampf caves.

The matter was taken up by three of the leading archaeologists of Scotland—Mr. W. Graham Callander, Mr. James E. Cree and Dr. James Ritchie. They issued a preliminary report in 1927.[2] They explored several caves, including one known as the "reindeer" cave. In the floor of this cave two of its many strata were richly charged with animal bones. In the deeper and older stratum there was a vast number of shed and broken antlers of young reindeer, representing more than 400 animals, as well as bones of the Arctic animals already mentioned as having been found by Drs. Horne and Peach. A number of the antlers showed plainly the handiwork of man. In the upper fossiliferous stratum many of the bones were of

1 Dr. James Ritchie, "The Fauna of Scotland during the Ice Age", *Proc. Roy. Physic. Soc. Edin.*, 1928, vol. 21, p. 185.

2 *Proc. Soc. Antiquaries, Scot.*, 1927, vol. 1 (ser. vi), p. 169.

existing species, as well as of others no longer living in Scotland. In this upper stratum there were human bones, representing two individuals, one of whom had been deliberately buried. From the nature of the fauna, the cogency of the geological and zoological evidence and the fossilized state of the human bones, Dr. Ritchie was led to conclude that the reindeer cave at Inchnadampf had been frequented by man during the latter part of the ice age, the occupation corresponding in time to the Magdalenian culture of France, perhaps earlier. The finding of palaeolithic man so far north is altogether surprising and whets the imagination as to what may yet be found.

In the search for the forerunners of modern man we are now to pass from Scotland to Ireland. The transition is natural, for the land bridge which linked Ireland to the outside world in late palaeolithic times lay between Western Scotland and Northern Ireland.[1] An elevation of the land or a subsidence of the sea to an extent of 150 feet would again unite Ireland to North Britain. As to the region of Ireland which is most likely to give us what we are in search of—the kind of men who lived in Western Europe just after the last ice age, there can be no doubt. It is the southern counties of Waterford and Cork, particularly the limestone valley—the Blackwater Valley—which, beginning at Dungarvan Harbour on the south coast of Waterford, strikes westwards across County Cork. If anywhere, it is here that we are most likely to find traces of the ancient inhabitants of Ireland, for two reasons. The first is that the Blackwater Valley lay just beyond the southern margin of the ice sheet which submerged Ireland at the height of the last period of glaciation; the second is that the limestone caves of this valley provide suitable conditions for the preservation of human as well as animal remains. The archaeologists of Ireland have been alive to the possibilities of this limestone region, and at an early date began a systematic

[1] For other possible land connections, see a paper communicated by J. K. Charlesworth to the *Proc. Roy. Irish Acad.*, February 10, 1930.

examination of its caves. As an example of the earlier investigations I may cite the exploration of the cave at Ballynamintra, Waterford, carried out by Leith Adams [1] in 1880. A diagram of the strata found in the floor of this cave is reproduced in fig. 139. The strata are reminiscent of those found in the caves of the Mendips, on the English side of St. George's Channel. There is first an upper layer of black soil 2½ feet in depth in which relics of the neolithic and more recent periods were found. Under the black soil came stratum 2, 3 feet in thickness, made up of a breccia in which were blocks of stalagmite, the stalag-

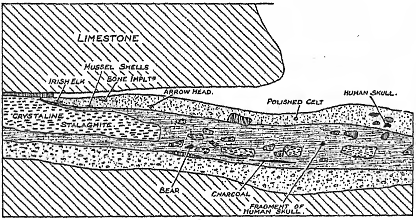


FIG. 139.—A diagrammatic section of the strata of Ballynamintra cave, Waterford, as registered by Leith Adams.

mitic layer being intact only in the recess of the cave. In the breccia, presumably of late palaeolithic age, were traces of hearths (fig. 139), the fossil skull of a brown bear and fragments of a human skull. The third and deepest stratum was made up of gravel, as also happens in the caves of the Mendips. Here we find just such strata as we are in search of, and we learn from those at Ballynamintra that palaeolithic man did exist in Ireland, but we obtain no indication of the kind of men who occupied the cave so long ago.

How rich Southern Ireland was in wild game during and after the last ice age is made evident by the lifelong

[1] A. Leith Adams, *Trans. Roy. Dub. Soc.*, 1880, vol. 1 (ser. 2), p. 177.

investigations of Dr. R. F. Scharff. In Castlepook cave, situated in the Ballyhoura Hills, to the north of Doneraile, County Cork, he obtained over 30,000 bones and teeth of pleistocene animals.[1] The fauna included the mammoth, reindeer, red deer, Arctic bear, spotted hyaena, wolf, Arctic fox, horse, Irish "elk", two species of lemmings—a fauna very similar to that which is represented in pleistocene strata of English caves. It is clear from such evidence that game had free access to Ireland during the latter part of the pleistocene period, and it would be strange indeed if palaeolithic hunters did not follow such a plentiful supply of food into the extreme west of Europe. In the vast chambers and passages of Castlepook no trace of humanity was observed.

In the summer of 1928 members of the Royal Irish Academy and of the Spelaeological Society of Bristol University linked forces and began an exploration of the cave fauna of Southern Ireland under the direction of Mr. E. K. Tratman. The site selected was Kilgreany cave in County Waterford. The cave is situated in a limestone cliff which rises from the marshy valley which passes westwards from Dungarvan harbour, being only a few miles distant from Whitechurch, which is also situated in the valley and is rich in caves. Kilgreany cave opens—or rather did open, for part of the roof had been cut away by quarry-men before investigations began—on the south-eastern aspect of the cliff, 50 feet above sea-level. In fig. 140, taken from the official report,[2] are given the strata which were exposed in the floor of the cave. The excavators penetrated to a depth of 12 feet. The upper strata, down to a depth of 4 feet below the original surface of the cave floor, need not detain us; they contain objects which prove they were laid down in neolithic and later times. At two levels in these upper strata were found hearths (fig. 140) and scattered human remains representing at least eight individuals. Under these upper

[1] See *Proc. Roy. Irish Acad.*, June 25, 1917. See also "Third Report of the Committee for the Exploration of Irish Caves", *ibid.*, 1918, vol. 34, No. 3.
[2] *Proc. Spelaeological Society of Bristol University*, 1928–29, vol. iv, p. 137.

deposits, at a depth of 4 feet, began a stratum of the highest importance; it was made up of an open tufaceous stalagmite, formed at some former period on the floor of the cave. It was closely examined and found to be unbroken. Under the tufaceous layer came one of hard crystalline stalagmite, also intact. Above the crystalline stalagmite, but under the tufaceous stratum, was sandwiched an ancient hearth (fig. 140), the oldest trace of man found in the cave, for the crystalline layer and the stony strata which followed underneath were sterile; no living thing

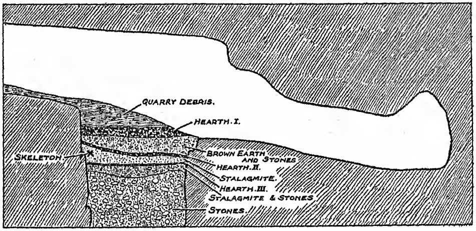


FIG. 140.—Section of the deposits found in a quarry at Kilgreany—the site of a former cave.

had frequented Kilgreany cave when they were in process of deposition.

Soldered within the tufaceous stratum, at a depth of 4½ feet beneath the upper layer of the cave floor, was a human skeleton, that of a man (fig. 140). The body seems to have been buried in a kneeling position and leaning against the western wall of the cave. The bones of his feet rested on the deepest hearth (No. III). The question which has to be answered is: When was the man buried in the cave? It was certainly before the formation of the tufaceous stratum which had grown up round his bones. No implement was found in the tufaceous deposit to assist the excavators in fixing his place in the scale of palaeolithic cultures; they had to depend for dating on

the fauna which accompanied the skeleton. The fossil animal bones in the tufaceous stratum were examined by Dr. J. Wilfrid Jackson of Manchester Museum.[1] These bones represent the reindeer, giant deer (Irish elk), Arctic lemming, a continental vole, brown bear, wolf, ox and wild boar. With such a fauna round the Kilgreany man we may safely regard him as contemporary with,

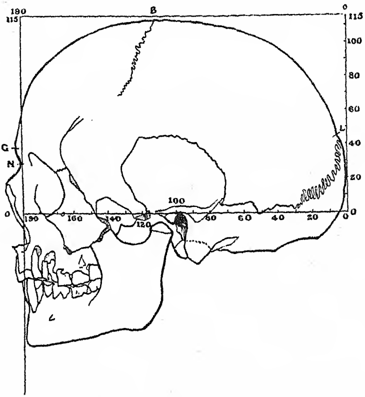


FIG. 141.—Profile of the skull of the Kilgreany man oriented on the Frankfort plane. (After Prof. Fawcett.)

if not more ancient than, the cave men of Aveline's Hole. He represents the earliest inhabitant of Ireland known to us.

The human remains from Kilgreany cave were examined and described by Professor E. Fawcett[2]; in figs. 141, 142 are reproduced Professor Fawcett's drawings of the skull of Kilgreany man. Looked at in profile (fig. 141) it is seen to be a long skull—194 mm.; its width is moderate—139 mm., being 71·6 per cent. of the length.

[1] *Proc. Spelaelog. Soc. Bristol*, 1928, vol. iv, p. 137. [2] *Ibid.*

Kilgreany man was decidedly dolichocephalic. As is often the case amongst the modern descendants of Gaelic-speaking peoples of Ireland and Scotland, the vault of his skull was of low pitch, rising only 111 mm. above the ear passages. With this reduced height of the vault is correlated a low and horizontal position of the occipital bone, the greater part of which lies under the level of

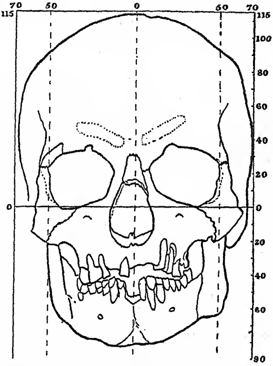


FIG. 142.—Outline of the skull of Kilgreany man as seen in full face, oriented on the Frankfort plane. (After Prof. Fawcett.)

the Frankfort plane (fig. 141)—a recent, not a primitive feature. His brain capacity was moderate, about 1450 c.c.

If we except the degree to which the teeth are worn down, there is no primitive feature to be detected in his face or jaws. His face was rather short, measuring, from nasion to lower border of the chin, 113 mm.; the cheek bones and cheek (zygomatic) arches were somewhat prominent, the width of the face (bizygomatic) being 138 mm. The chin was moderately developed but not deep, the height of symphysis in the middle line being only 30 mm. On the other hand, his face was wide at

the jowls, the angles of his lower jaw being 105 mm. apart. His dental palate was only slightly above the mean for modern Englishmen, its length being 51 mm., its width (taken at the second molars) 62 mm., and its area 26·5 cm.^{2} The width of the ascending ramus of his lower jaw—a good indication of masticatory development—measured 37·5 mm. In tooth and jaw development the Kilgreany man shows no approach to the more robust Magdalenian men of the continent, such as the Chancelade or Obercassel man. His jaw and face development correspond rather to the weaker state seen in the post-Magdalenian peoples of France and England.

The most peculiar features of the Kilgreany man are to be seen in his forehead. It is wide, 102 mm., and low, although not receding. The supra-orbital ridges are well developed, and the two elements which make up these arches—the supraciliary and supra-orbital—are separated in a peculiar manner, the supraciliary eminences rising more steeply above the supra-orbital parts than is usual. This arrangement is probably a family rather than a racial trait. Nevertheless, Professor Fawcett has drawn my attention to a similar conformation in Irish skulls of recent date. The outer ends of the supra-orbital ridges are prominent, the supra-orbital width being 111 mm. This is much less than the remarkable width attained in another Irish skull of ancient but uncertain date—the Borris skull[1] dredged from the bed of the River Nore, in Queen's County. In the Borris skull the supra-orbital width is 120 mm.; this massive skull is of the same type, and shows the same peculiarities of conformation as the skull of the Kilgreany man. The nose of the Kilgreany man was of moderate prominence, short (48 mm.) and not wide (24 mm.). He represents a modified form of the long-headed type of neanthropic man which began to spread westwards in Europe in the Aurignacian interlude of the last period of glaciation.

Three other human skulls or parts of human skulls were found beneath the second hearth (fig. 140) and

[1] See Huxley, in Laing's *Prehistoric Caithness* (1866), p. 125.

presumably are less ancient than the skeleton found within the tufaceous layer. One of these skulls is that of a woman, and may well represent the female counterpart of the Kilgreany man. This skull is 183 mm. long, 133 mm. wide and 114 mm. high (auricular height). The face was short and narrow (bizygomatic width 122 mm.). The minimum width of the ascending ramus of the lower jaw was 33 mm., an indication of a reduced development in jaws and chewing muscles. This skull shows no feature which can be called primitive.

Do the human remains found in Kilgreany cave represent the first arrival of man in Ireland? Seeing that Europe has been inhabited by human beings throughout the pleistocene period, and that Ireland has been in existence and habitable for long stretches of that time, it does seem unlikely that the first human settlement of the Western Isle should be so late as the closing phase of the last ice age. In the limestone caves of Sligo, which lie well within the area of glaciation, there are strata which contain fossil remains of a fauna similar to that preserved in the caves of Waterford and Cork; but so far no trace of cave man has come to light. That man arrived in Ireland at a much earlier date than has hitherto been supposed becomes probable in the light of discoveries made in 1927 by Mr. J. P. T. Burchell on the beach at Rosses Point, Sligo. There a low promontory is formed by overhanging limestone rocks. In the beach and under blocks of limestone which had fallen from the projecting ledge, Mr. Burchell gathered a series of implements fashioned out of limestone. He refers the implements to types made by the men of Europe at the very beginning of the period of Mousterian culture.[1] He regards Rosses Point as having provided a rock-shelter for early Mousterian man. Mr. J. Reid Moir has examined the Sligo implements and the evidence for their geological anti-

[1] *Nature*, August 20, 1927, p. 261 (vol. 120). See also *The Early Mousterian Implements of Sligo, Ireland*, by J. P. T. Burchell and J. Reid Moir, Ipswich, 1928. *Occasional Papers* published by the Prehistoric Society of East Anglia. See No. 1, 1929, by Messrs. Burchell, Reid Moir and Dixon.

quity and gives the weight of his authority to support Mr. Burchell's claims. On the other hand, four of the leading archaeologists and geologists of Ireland can detect no evidence of human workmanship in the Sligo implements and reject the geological evidence adduced by Mr. Burchell in favour of their antiquity.[1] Meantime, at least, we have not yet discovered any human remains in Ireland which can be attributed to an earlier date than the closing phase of the last glaciation—which in the calendar of time used in this work gives them the moderate antiquity of some 8,000 years, or 10,000 years.

[1] *Nature*, December 31, 1927, vol. 120, p. 249. A letter signed by Messrs. R. A. S. Macalister, J. Kaye Charlesworth, R. Lloyd Praegar and A. W. Stelfox.

CHAPTER XXIX

THE DISCOVERY OF THE LONDON SKULL

In *The Times* of October 28, 1925, Mr. Warren R. Dawson announced that an important discovery of fossil man had been made right in the heart of the city of London. The site of the discovery, an area lying in the angle between Leadenhall Street and Lime Street, is shown in fig. 143; it is in the busiest part of the city, 500 yards distant from the river and the northern end of London Bridge, and about the same amount to the east

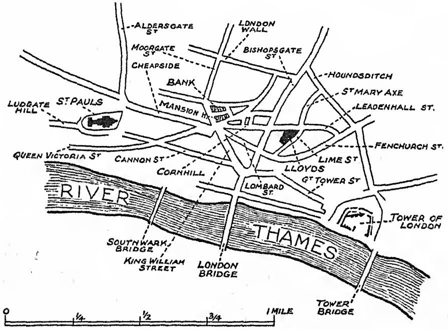


Fig. 143.—Sketch map of the city of London, showing the position of Lloyd's Buildings in relationship to the Thames, London Bridge, Bank of England, Mansion House and St. Paul's Cathedral.

of the Mansion House and Bank of England. On this site had stood the famous East India House, but the Corporation of Lloyd's, which covers the shipping risks of all the mercantile fleets of the world, having acquired it, began in the summer of 1925 to dig deep foundations for its new buildings. At a depth of 42 feet,[1] under several strata of undisturbed deposits, a large part of a

[1] This is the depth given by Mr. Dawson.

fossilized human skull was found. In the course of the excavations remains of the mammoth had been encountered—head of a thigh bone and molar teeth; antlers and limb bones of the red deer; the skull of an ox; and from the same level as the human skull the ulna of a rhinoceros, probably that of the woolly rhinoceros (*R. antiquitatis*). No stone implements of ancient man were observed as the foundations were dug. Mr. Dawson claimed that the skull found at Lloyd's represented the "earliest Londoner" so far discovered. Of that there can be no doubt.

Previously, at a meeting of the Zoological Society of London, held on October 10th, the skull and associated remains were shown and discussed.[1] Mr. A. C. Hinton, of the British Museum, who has devoted his life to the study of the geological deposits of the lower valley of the Thames and of the animals which lived in England when these deposits were being laid down, gave it as his opinion that the deposits which were opened up at Lloyd's had been formed in the last phase of the pleistocene period. It was a phase when England sheltered an "Arctic" fauna, and for this reason the deposits at Lloyd's, in which the "London" skull was found, must be assigned, so Mr. Hinton believes, to the lowest and latest of the Thames terraces—that named the 20-foot terrace, because this is the usual height it rises above the present level of the river. It is in this lowest terrace we find the tools of later palaeolithic man—man of the neanthropic type. The Lloyd's skull was therefore presumably post-Mousterian in date; it belonged to the period which followed the disappearance of Neanderthal man from the continent of Europe.

Fortunately the examination and description of the human skull was undertaken by an anatomist of the highest standing—Professor G. Elliot Smith—in whose keeping it now is at University College, London. The problem of assessing the racial affinities of the skull was rendered particularly difficult because only its hinder

[1] *Proc. Zool. Soc.*, 1925, pt. 2, p. 793.

two-thirds were preserved; the forehead, face and base were entirely missing; no part of the lower jaw was found; it was merely a stray fragment which had become embedded in an ancient bed of the Thames. In the part of the skull thus fortunately preserved, Professor Elliot Smith found a strange mixture of characters.[1] It was marked by female traits, and had a brain capacity of not more than 1250 c.c.—some 50 c.c. less than is usual amongst English women of to-day. In many details Professor Elliot Smith found that the cranial characters of the London woman departed from those of neanthropic (modern) humanity and approached those of the Neanderthal type. Yet the differences were sufficiently great to exclude all possibility of assigning the London woman to the Neanderthal species. The discovery of the fossil remains of Neanderthal man in England, where his ancient workshops abound, has still to be made. In the meantime the London skull presents anatomists with problems of the highest interest and importance. Professor Elliot Smith was conscious of these problems when he wrote: "The likeness (to the Neanderthal type) is so real as to raise for serious consideration the possibility whether in Britain a stray member of the Neanderthal species may not have survived after the Mousterian phase of culture had been superseded by the Aurignacian." This is one way of explaining the peculiar characters of the fossil London skull. There is another possible explanation—namely that the London skull is not of Aurignacian date but is much older, and represents neither neanthropic man nor Neanderthal man, but a third type which is already known in England—the Piltdown type or one near akin to that type. It is this possibility we are now to explore.

No sooner had the assignment of the London skull to an Aurignacian horizon been made than a letter appeared

[1] For Professor Elliot Smith's description of the London Skull and his conclusions as to its racial position, see *Nature*, November 7, 1925 (vol. 116, p. 678); *Brit. Med. Journ.*, November 7, 1925 (vol. 2, p. 854); *Evolution of Man*, 2nd ed., 1927, p. 176.

in *Nature* [1] from the officer of the Geological Survey (Mr. C. N. Bromehead) who had been responsible for mapping out the geological deposits on which the city of London has been built. In Mr. Bromehead's opinion the deposits *under* which the London skull had been found belonged to, not the later and lowest terrace deposits of the Thames Valley—the "20-foot" terrace—but to the much older series—the "50-foot" or Taplow terrace. The significance of this authoritative verdict will

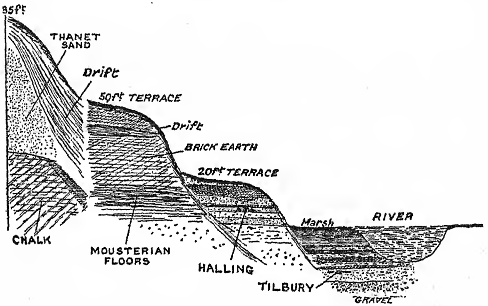


FIG. 144.—A diagram of the submerged bed, lowest or 20-foot terrace and of the middle of 50-foot terrace of the Thames Valley.

be apparent if the reader consults the diagram reproduced in fig. 144, in which the sequence of terraces found along the lower valley of the Thames is depicted. Although the terraces are not marked off from each other in the diagrammatic manner shown in fig. 144, yet the most recent investigations have demonstrated the essential truth of such a representation. If the city of London is built on a terrace representing the 50-foot series, then the London skull, which was found under the terrace, is very much older than the Mousterian period of culture, for the workshops of the period occur in the brick-earths in its

[1] *Nature*, December 5, 1925, vol. 116, p. 819.

upper and later deposits. The gravel terrace on which the city of London has been built is shown in the ordnance survey maps [1] as a great continuous sheet which extends eastwards into the valley of the Lea (fig. 145), whilst westwards it is continued under the British Museum, Oxford Street, Hyde Park, Kensington and Acton. At Acton, Mousterian floors occur in the brick earths of this (the Taplow) terrace.[2] Under the terrace, in Hyde Park, Mr. H. Dewey [3] has recorded the discovery of unabraded implements of the Chellean type; the same ancient type of palaeoliths has been found under the terrace at Piccadilly Circus, Drury Lane and Berkeley Square.[4] The palaeoliths which were described in the *Philosophical Transactions* so long ago as 1728 were found in deposits of the "50-foot" terrace when excavations were being made in Gray's Inn Lane. Thus the evidence collected by geologists and by students of man's palaeolithic tools indicates a much greater antiquity for the London skull than that which has been assigned to it by Mr. A. C. Hinton. In place of the skull representing a people who lived in the Thames Valley in later palaeolithic times, it represents a much older type—one which shaped implements in the earlier palaeolithic manner.

The evidence of the skull itself favours such an interpretation of the geological evidence. In a previous chapter (Chap. XXVII) the skulls of the later palaeolithic inhabitants have been described; all are modern in type. The same is true of the human skulls recovered from the later terrace deposits of the Thames and Medway.[5] All the human skulls which have been found on the continent of Europe, within strata of post-Mousterian date, are clearly and unmistakably of the modern type.

[1] See *Geology of the London District*, 2nd ed., 1922, pp. 49–70; *Geology of North London*, 1925, pp. 44–49. Also London one-inch map No. 256 (North London), six-inch map No. 7 (S.E. London).

[2] J. G. Marsden, "Mousterian implements from the brick-earths at Acton", *Proc. Prehist. Soc. East Anglia*, 1927, vol. 5, p. 297.

[3] *Proc. Geo. Soc.*, May 20, 1925.

[4] C. E. N. Bromehead, *The Geology of North London*, 1925.

[5] See *Antiquity of Man*, vol. i, chapters vi, vii, viii.

Either an error has been made in assigning the London skull to a late palaeolithic date, or, as has been suggested by Professor Elliot Smith, an early human type had become sequestered in England, and when all the rest of Europe was inhabited by neanthropic man, this strange type still survived in the valley of the Thames. Clearly our first task is to make a more detailed examination of

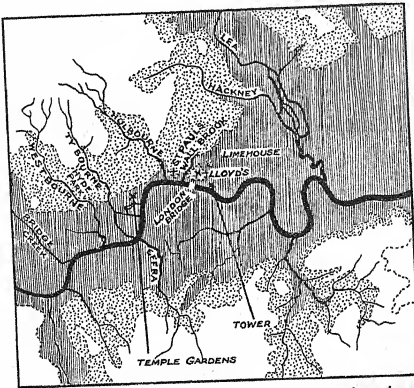


Fig. 145.—A sketch map of the site of London city, taken from the official map of the geological survey. The land lying below the 50-foot contour line is shaded; that which lies above the 50-foot contour and under the 100-foot is stippled. In the stippled area occurs the gravels of the 50-foot terrace.

the geological and other evidence relating to the discovery and antiquity of the skull than has been published so far.

When we look at a contour map of that part of the northern bank of the Thames on which the city of London has been built, we are at once struck by an isolated area, lying at the northern end of London Bridge, which rises above the 50-foot contour line (fig. 145). In this isolated area the foundations for Lloyd's buildings were dug. Lloyd's area has been cut off from the adjacent parts of the 50-foot terrace by the

Wall Brook, in the filled-up valley of which have been built the Bank of England and Mansion House. Thus it will be seen that for some distance both above and below London Bridge the Thames flows almost directly against the base of the 50-foot terrace. There is here no remnant of the deposits of the 20-foot terrace left. We may reasonably suppose they have been washed away, for when we ascend the river bank to the Temple Gardens (fig. 145) the 20-foot deposits are in place and continue upwards to Westminster; below, they commence beyond the Tower of London and continue under the streets of Limehouse (fig. 145). Thus geologists regard the site on which Lloyd's buildings were erected in 1925 as being part of the 50-foot terrace.

Wishing to obtain more exact details regarding the strata cut through at Lloyd's than have been published so far, I appealed to the architect of the building, Sir Edwin Cooper, who kindly supplied me with his sectional records on which are shown the spot at which the skull was found—towards the south-eastern corner of the excavated area—and the series of strata which were cut through, the levels of each layer being given both below the pavement of Lime Street and above the mean tide level of the river—the ordnance datum level. A diagram prepared from the architect's plans and sections is reproduced in fig. 146; it differs in certain but immaterial respects from the data published by Mr. Warren Dawson. The official section shows the stratum of blue London clay underlying the skull as beginning at a depth of 36·79 feet (11·40 metres) below the surface of the pavement and 20 feet (6 metres) above the present level of the Thames, whereas Mr. Dawson gives the depth to the blue clay as 40 feet. The skull lay within a stratum of brown clay, only a foot in thickness, which overlies the blue clay. It is possible that the stratum in which the skull was found represents an old land-surface (Reid Moir). However this may be, the stratum which follows above it, one which is 3½ feet thick and made up of bedded sands and loams—a kind of brick-earth—

represents a deposit laid down in still or slow-running waters of the ancient Thames. Over the loam deposit comes an old bed of the Thames, a stratum of coarse gravel and stones ("pit ballast") 5½ feet in thickness. Over the gravel bed follows another deposit of the

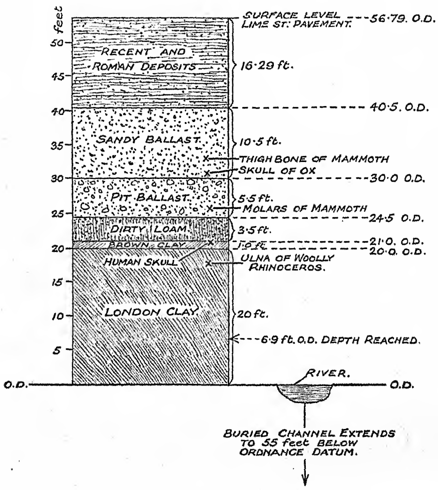


Fig. 146.—A section of the strata in which the London skull was embedded. The diagram is compiled from the architect's plans. The position of the skull is that recorded by Sir Edwin Cooper's staff. The position of the other fossil remains is that given by Mr. Warren R. Dawson.

ancient river, 10½ feet in thickness and made of sands and gravels—"sandy ballast". The upper limit of the deposits laid down in the ancient bed of the Thames ceases at 40 feet above the present level of the river (fig. 146). Over the riverine deposits come 16½ feet of material which has accumulated on the old land surface in Roman and later times.

A survey of such a section compels one to realize the vast physical changes which have taken place in the valley of the Thames since the entombment of the skull of this ancient Londoner. There have been many and great alterations in the level at which the Thames flowed. In the earlier part of the pleistocene period so great was the submergence of the land—or so great was the rise in sea-level—that the river flowed along its valley 100 feet above its present channel, laying down in its bed the deposits which make up the 100-foot terrace. At a later period, so much was the land raised (or sea-level lowered) that the Thames cut its bed 55 feet below its present level. There have been times of land subsidence when the Thames filled its bed and estuary with deposits; there have been times of elevation when the river cleared away these deposits, leaving remnants here and there; such remnants make up her present terraces. Clearly the immense spread of gravel on which a great part of London is built—the sheet of gravel and sands which sealed down the London skull—occurred during a period of subsidence, the bed of the river ultimately reaching a level of 50 feet above the present one. The vast extent of the gravel deposits suggest a mighty Thames—one swollen with turbulent waters, drawn from melting snow and ice. The fossil bones found in the London gravels and loams indicate an Arctic fauna. The gravel deposits over the London skull, we may infer, were laid down as a sequel to one of the ice ages which overwhelmed Northern Europe during the pleistocene period. The question is: Which ice age gave London her 50-foot terrace? Our prehistoric Londoner is older than the 50-foot terrace.

At Crayford, on the southern side of the Thames Valley, some 12 miles below London Bridge (*Antiquity of Man*, vol. 2, fig. 57, p. 158), there is preserved a remnant of the 50-foot terrace which has been much studied by geologists and zoologists. A section of the deposits at Crayford are shown in fig. 147. When the deposits at Crayford began to be laid down, the Thames was flowing some 50 feet above its present level. At Lloyd's the ancient gravel bed

of the river lies between the 24th and 30th foot O.D.; at Crayford the gravel bed, here considerably greater in thickness, rises, in the part furthest from the river, to the same level—between the 18th and 30th feet O.D. This gravel bed, when traced towards the river, dips down under the deposits of the 20-foot terrace, just as does a corresponding bed of gravel in the lower valley of the Somme. Over the gravel bed, at the base of the 50-foot terrace at Crayford, comes a series of deposits—sands and brick-earths, 30 feet thick—all laid down in a period of subsidence when waters of the Thames ran

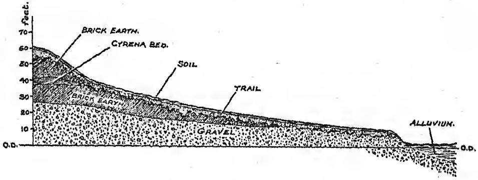


Fig. 147.—A section of the deposits which constitute the 50-foot terrace at Crayford. (R. H. Chandler.)

slowly and the valley was filling up. All the geological evidence points to the deposits at Lloyd's and at Crayford as having been laid down in the same period of subsidence and during the same climatic disturbance.[1] Now, in the deposits just over the gravel bed at Crayford are found late Acheulean work floors, the implements being of a transitional kind, and are called late Acheulean by some, and early Mousterian by others. At higher levels of the brick-earths occur typical implements of the fully developed Mousterian culture—the culture of Neanderthal man. This is in keeping with what has been found at Acton, where Mousterian floors occur in the brick-earths of the Taplow or 50-foot terrace.

The geological evidence is most definite; the gravel

[1] For further details of the deposits of the 50-foot terrace, see *Antiquity of Man*, vol. i, pp. 158, 228.

bed which covered the London skull was laid down before the Acheulean culture had reached its last phase and long before the Mousterian culture had begun. The cultural evidence is also definite; the implements found under the gravel bed of the 50-foot series is Chellean—late Chellean. If the gravel bed marks a glacial period, then that glaciation was not the Würm or last—the glaciation which overtook Neanderthal man—but one which led to the deposition of the contorted drift and deep boulder clay which overlie the Cromer beds of East Anglia. Mr. Reid Moir has found Chellean implements in the Cromer beds; Acheulean implements occur in brick-earths lying above the deep boulder clay.[1] If readers will consult the chronological scale which is also used in *Antiquity of Man* (fig. 162, p. 464) it will be seen that the earlier pleistocene glaciation is placed between the pre-Chellean and Chellean periods of culture. There is a growing volume of evidence which places this great glaciation not before but after the period of Chellean culture. We are thus compelled, if we accept the geological and cultural evidence, to give the London woman a much higher antiquity than that given to her by Mr. Hinton and Professor Elliot Smith. We have to lift her back a whole cycle of climatic change and place her, not in the last (Würm), but in the first pleistocene glaciation—the Mindel glaciation of Penck (see fig. 162, p. 464). She is early, not late, pleistocene in date.

Now if we had to depend entirely on geological and cultural evidence, we should unhesitatingly give the London skull the greater antiquity I am claiming for it. There is, however, another line of evidence which deserves our most serious consideration. It is the evidence which has been gathered during the past thirty years by Mr. A. C. Hinton and Mr. A. S. Kennard. Both have searched the pleistocene deposits of East Anglia and of the Thames Valley—Mr. Hinton for fossil remains of mammals, Mr. Kennard for fossil shells. Both have come independently

[1] See deposits at Hoxne, *Antiquity of Man*, vol. i, pp. 240, 291; also Mr. Reid Moir's account in the *Proc. Prehist. Soc. East Anglia*, 1927, vol. 5, p. 137.

to the same conclusion, namely that an Arctic fauna did not enter the Thames Valley until the brick-earths which overlie the gravel bed at Crayford began to be laid down.[1] Then the fauna of England suddenly changed for the first time—the mammoth and woolly rhinoceros arrived, and northern molluscs replaced the older temperate-living species. Now if this is a just inference, then there can be no doubt as to the age of the terrace which overlies the London skull and over which passes the thunder of London's busy traffic. During the excavation at Lloyd's, fossil remains of the mammoth were found; at Endsleigh Gardens, which are on the same terrace of gravel, and 2½ miles to the west of Lloyd's buildings, fossil remains of the mammoth were encountered at the base of the terrace deposits.[2] If Mr. Hinton is right about the first arrival of an Arctic fauna, then the gravel and other beds which cover the London skull were laid down after the brick-earths were deposited at Crayford, there burying the handiwork of Mousterian man. The London woman would thus be, as Mr. Hinton and Professor Elliot Smith maintain, a contemporary of the later palaeolithic races of Europe.

The contradiction between the geological and cultural evidence on the one hand and the faunal evidence, as interpreted by my friends, Messrs. Hinton and Kennard, on the other, is sharp and decided. The one or the other is right; for my part I accept the geological and cultural evidence and assign the London woman to a late phase of the Chellean culture. I am moved thereto by the following considerations. Mr. Hinton has shown that the fauna of the Cromer beds in East Anglia is the same fauna as occurs in the deeper deposits of the 100-foot terrace of the Thames Valley. We may regard these deposits as contemporary and as having been laid down early in the pleistocene period—the period to which

[1] A. C. Hinton, "The Pleistocene Mammalia of the British Isles and their bearing on the Date of the Glacial Period", Manchester, 1926. See also references to other papers given in *Antiquity of Man*, vol. i, pp. 165, 290.

[2] *The Geology of North London*, 1925.

Piltdown man has been assigned. Over the Cromer beds lie the deep boulder clay and contorted drifts; they are typical glacial deposits; under them occur Chellean implements; over them Acheulean. We cannot suppose these great glacial deposits of East Anglia are contemporary with the brick-earths of Crayford; they are much older. Was there no change in the fauna of England under such Arctic conditions? Mr. A. C. Savin [1] has found fossil remains of the mammoth, musk-ox and elk (*Alces latifrons*) under the boulder clay of East Anglia—sparingly it is true—still, sufficient to indicate that Mr. Hinton may be mistaken as to the late arrival of an Arctic fauna in England.

We shall appeal in the next chapter to the skull itself for evidence of its antiquity.

[1] See Dr. Henry Fairfield Osborn, *Geol. Mag.*, 1922, vol. 59, p. 433; *Bull. Geolog. Soc. Amer.*, 1929, vol. 40, p. 589; see also Mr. J. E. Sainty's account of an Acheulean workshop on the 50-foot deposits of the Yare Valley and his remarks on fauna, *Proc. Prehist. Soc. East Anglia*, 1927, vol. 5, p. 191.

CHAPTER XXX

THE PILTDOWN AFFINITIES OF THE LONDON SKULL

LET us look first at the part of the skull which has been preserved; from it we have to interpret the nature of a human being who lived in the valley of the Thames before even the ground on which London is built had come into existence. In fig. 148 an exact drawing of the skull is given in true profile[1] and oriented on the sub-

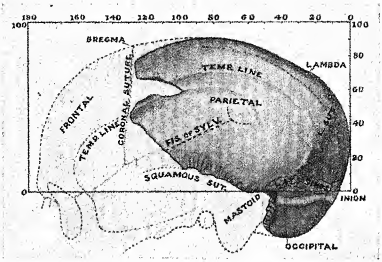


FIG. 148.—The London skull seen in true profile and oriented on the sub-cerebral plane. The parts actually found are shaded; the missing parts are indicated by stippled lines.

cerebral plane.[2] The part actually recovered is shaded and consists of two bones, the occipital which encloses the hinder part of the brain—the cerebrum above, cerebellum below—and the parietal bone. At one point the latter bone reaches forward almost to the coronal suture (fig. 148). We know that this is so because the lower anterior part is marked by the groove for an artery

[1] The drawings have been made from an excellent and accurate cast made by Mr. F. O. Barlow. Thanks to the courtesy of Professor C. Elliot Smith, I have had opportunities of comparing the cast with the original and of studying the latter.

[2] For an explanation of this plane—which I introduced for the reconstruction of fragmentary human skulls—see *Antiquity of Man*, vol. ii, p. 582.

which ascends just behind the coronal suture. Now when the skull of an average Englishwoman is oriented as the London woman's skull is, in fig. 148, with the base line O, O passing through the lower hinder angle of the parietal bone, the highest point of the vault usually reaches the 100-mm. level—the upper line of the framework shown in fig. 148. I have represented the skull of the ancient woman as having a particularly low pitch; it is shown rising only 90 mm. above the base line, and the reader will naturally ask: How has the pitch of the vault been determined? The lower the pitch of the vault the smaller is the brain. The pitch is determined in this way: when oriented on the plane shown in fig. 148, the highest point of the vault of human skulls lies 40 to 50 mm. behind the bregma; the "highest point" is preserved in the London skull; in skulls of the modern type the vault sinks as it passes towards the bregma; only in very primitive skulls, such as that of Pithecanthropus, is the bregma as high as the vault of the parietal bone. If we raise the vault of the London skull beyond the level shown in fig. 148, the contour becomes such that we must place the bregma at a higher level than the vault of the parietal. Nor can we place the vault lower, for the inferior or squamous border of the parietal bone is only 15 mm. above the base line. Thus the London woman was primitive in that the vault of her skull was low—only 90 mm.; in the Gibraltar woman it was still lower—only 86 mm., but then she was exceptional, even as a representative of the Neanderthal type. The vault height of Sinanthropus is only 76 mm. Pithecanthropus had an even lower brain, the vault of his skull rising only 74 mm. above the base line. We shall see, however, that the skull of a woman dredged from the bed of the Thames, and probably dating from the Roman period, had a vault almost as low as the London woman.

We can make an approximate estimate of what the length of the London skull was when it was intact. In fig. 148 it will be seen that the lower projecting piece of the parietal bone almost reaches the coronal suture; at

this point will be recognized the attachment lines for the temporal muscle—just after they have crossed the coronal suture (fig. 148). Now in human skulls, both ancient and modern, about 70 per cent. of the length of a skull—the part made up of the parietal and occipital bones—lies behind this point, while the frontal bone usually makes up about 30 per cent. of the length. In the London skull the length of the parieto-occipital part is

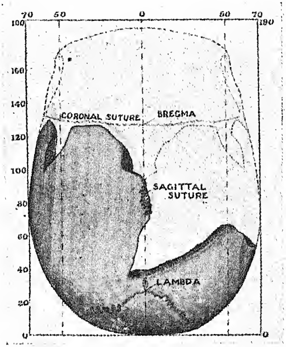


FIG. 149.—London skull oriented on the subcerebral plane and viewed from above. The parts actually preserved are shaded and the restored parts stippled. The outline of the more intact left side is reversed and indicated on the right side.

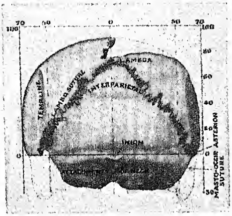
130 mm., so we infer that the frontal part was at least 55 mm., giving an original length of about 185 mm., quite a common measurement amongst modern English women.

In fig. 149 the London cranial fragment is viewed from above, the missing parts being filled in by fine shading. It will be seen that much more of the parietal bone has been preserved on the left than on the right side; nevertheless, one important suture is preserved on the right side which is missing on the left—the suture at

which the missing temporal bone makes its contact with the occipital bone. In fig. 148 this missing suture, the masto-occipital, is shown transferred from the right to the left side of the skull, while in fig. 149 the outline of the left parietal bone has been used to supply the missing parts of the right bone. As thus restored, the maximum width of the skull, which measures 140 mm., lies well forwards as in modern skulls and not far backwards as in Neanderthal skulls. Further, the width, 140 mm., represents 75·5 per cent. of the estimated length. Thus in shape the London woman's skull lies on the border line between the dolichocephalic and mesocephalic classes and so far as its width and breadth are concerned is of good dimensions; it is only in the lowness and flatness of its vault that it is exceptional. It is legitimate to apply to the estimated dimensions of the London skull a formula used by Lea and Pearson for estimating the size of the brain chamber of female skulls. Such a formula gives its capacity as 1260 c.c., corresponding very closely to Professor Elliot Smith's estimate of 1250 c.c.

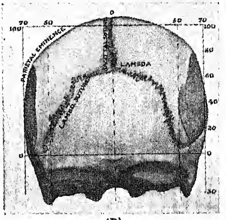
In fig. 150A another view of the London skull is given, that which is seen when it is placed on the sub-cerebral plane and viewed from behind. The missing parts are indicated by stippled lines. Beside fig. 150B is placed the corresponding view of a woman's skull, one which was dredged from the gravel bed of the modern river and probably represents a British Celt of the pre-Roman period. In the London skull there is an anomalous suture present, one which separates—or rather did separate, for the suture is now ossified—the upper part of the occipital bone from the rest, the part thus marked off being known as the interparietal bone. It is not uncommon to meet with such a bone in modern skulls, but I have never seen one in a human skull of palaeolithic date. It is to be counted not a primitive, but a lately acquired human feature. This bone in the London skull measures 31 mm. from its apex at the lambda (fig. 150A) to its base and 55 mm. along its base. Apart from this anomaly, the occipital view of the London skull closely

resembles that shown in fig. 150B. Both are almost the same width, but the vault in the more recent rises 15 mm. above that of the London woman. The fossil skull is low-vaulted, and there is another feature which catches the expert's eye: the vault and sides of the skull form parts of the same curved outline, there being no distinct parietal eminence, which is clearly indicated in the modern skull (fig. 150B). Further, the markings on that part of the occipital bone which give attachment to the muscles of the neck are closely similar in both skulls. The muscular



(A)

FIG. 150A.—Occipital view of the London skull. The missing parts are stippled. The skull was oriented on the subcerebral plane.



(B)

FIG. 150B.—Similar view of a woman's skull—one dredged from the bed of the Thames.

impressions on the London skull, clearly recognizable, indicate a muscular system of very moderate development, a circumstance we do not expect to meet with in primitive humanity.

Thus in our preliminary survey of the London skull the features we have met with are those which we are familiar with in modern specimens. There have, however, been three important exceptions: (1) the lowness of the vault; (2) the gradual way in which the curvature of the vault passes into the side of the skull, as seen in an occipital view (fig. 150A); (3) equally remarkable is the curvature by which the occipital bone, as seen in a profile view of the skull (fig. 148) passes into the curvature of

the vault. All these three features we must take into account in our search for the true racial affinities of this ancient and British specimen of humanity. Certainly they have not yet been met with in any human skull of late palaeolithic date. The Langwith skull,[1] Cheddar skull,[2] Baker's Hole skull[3] and Halling skull[4] have none of these features, but are in every respect comparable to modern European skulls.

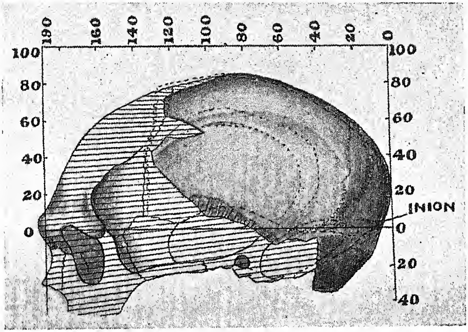


FIG. 151.—The London fossil skull seen in profile superimposed on the corresponding parts of the Gibraltar skull. The comparison has been made so that the upper (sagittal) borders of the parietal bones are made to correspond.

When we superimpose the London skull upon a profile of the Gibraltar skull—that of a Neanderthal woman, certain other peculiarities of the ancient Londoner become apparent. In fig. 151 the superimposition is so made as to permit a comparison of the profiles of the parieto-occipital part of the vault. The curvatures in the upper occipital and in the parietal regions agree, except that there is a greater degree of fullness in the region of

[1] See *Antiquity of Man*, p. 133.
[2] *Ibid.*, p. 137. [3] *Ibid.*, p. 162. [4] *Ibid.*, p. 115.

the lambda of the London skull. Along the lower or squamous border of the two parietal bones there is an extreme degree of contrast—both in the structure of the suture and in its direction. In its most forward point the parietal bone of the London skull just reaches the coronal suture of the Gibraltar skull. Above, however, the coronal suture of the two skulls could not have coincided. In the region of the bregma a considerable part of the London parietal is missing. Nevertheless, the Gibraltar coronal suture passes under the upper anterior part of the London parietal. In the London skull the coronal suture must have been set at a steeper angle than in the Gibraltar skull.

The essential difference between these two cranial types, however, is seen in the lower occipital region of the London skull, the part to which the neck is attached. The neck or nuchal part of the occipital bone of the Gibraltar skull is bent sharply forwards under the upper or supra-inial part of the bone (fig. 151), whereas the same part of the London skull continues downwards in the same gentle curvature as the upper part of the bone (fig. 151). Now this sharp nuchal bend which is seen in the Gibraltar skull is characteristic of many primitive and early human types: Pithecanthropus, Sinanthropus, Rhodesian man[1] and Neanderthal man—indeed, of all primitive skulls, save one—the Piltdown skull. At an early stage of my inquiries into the Piltdown skull my attention was arrested by its strange open nuchal angle and also the long gentle contour of the supra-inial part of its occipital bone—features which we again meet with in this ancient British skull found under the foundations of Lloyd's buildings. To whatever type or species we may assign the London woman, it cannot be to the Neanderthal species or type.

To elucidate this point I reproduce an old diagram, published in the first edition of *Antiquity of Man* (1915).[2] A series of sections shows the varying degrees of the nuchal

[1] See *Antiquity of Man*, vol. ii, fig. 139, p. 395.
[2] *Ibid.*, fig. 262, p. 707, and the test which that figure illustrates.

angle in the occipital bone in various skulls. The first of the series illustrates the inclination of the occipital bone in the orang; it is almost vertical. The second shows the

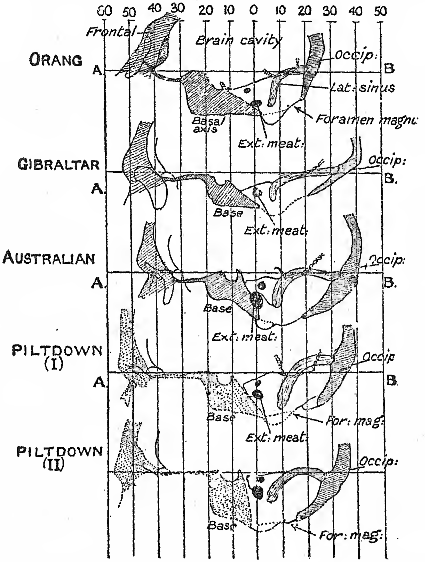


FIG. 152.—A series of sections showing the angle which the lower or nuchal part of the occipital bone makes with the upper part and also the relationship of the occipital bone to the base of the skull and to the ear passages.

sharp flexure or nuchal angle in a Neanderthal skull—the Gibraltar specimen. Now, in his original reconstruction, Sir Arthur Smith Woodward sought to give the occipital bone of the Piltdown skull the forward slope seen in other primitive skulls, with the result—as shown

in the lowest section (fig. 152)—that the base of the skull had to be unduly curtailed. On the other hand, I gave it the vertical position, shown as "Piltdown I" (fig. 152), and thus obtained room for a normal base and full-sized foramen magnum.

I was moved to place the Piltdown occipital thus because of several other considerations: (1) the forehead, so far as it was known to us, was modelled on orang lines[1];

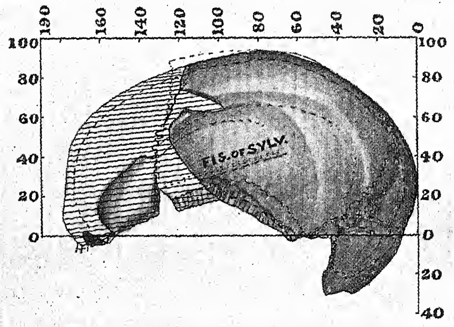


FIG. 153.—A profile of the London skull applied to one dredged from the bed of the Thames. The "river-bed" skull is 178 mm. long, 135 mm. wide, its vault rising 93 mm. above the subcerebral plane.

(2) articulation of the occipital with neighbouring bones could be obtained only when the occipital bone was thus placed. Further, it was necessary to presume that the upper or supra-inial part of the Piltdown occipital was relatively long and only gently curved. Now these features we meet with again in the London skull; the length of its supra-inial part, measured along the middle line to the

[1] Professor F. Frassetto (*Man*, 1927, vol. 27, p. 12) has demonstrated resemblances in the Piltdown mandible to that of the orang and concludes that Eoanthropus "represents a primitive race belonging to a genus of the orang type".

lambda, is 82 mm.; in the Piltdown skull I presumed it to have been 75 mm.

Before we proceed to compare the London and Piltdown skulls, let us take the nearest approach to the London skull which can be found amongst modern specimens and make a comparison. In the Museum of the Royal College of Surgeons there are over 100 skulls —more or less fragmentary—which have been dredged from the gravel bed of the modern river. The "London" skull is deceptively modern to the first glance of the eye; it is not until one has searched for its counterpart that one realizes the peculiarity of its features. The nearest approach to it I could find in the "river-bed" series was the skull of a woman shown in fig. 153. The height of the vault in the specimen chosen for comparison is 93 mm., nearly the same as in the fossil skull. In height, and also in the curvature of the occipital and parietal part of the vault, the two skulls correspond closely (fig. 153), but at three other regions the modern and ancient skulls differ from each other: (1) the nuchal part of the occipital bone descends more steeply in the fossil skull; (2) the lower or squamous border of the parietal of the London skull rises more rapidly as it passes forward than in the river-bed skull; (3) the bregma of the London skull was placed at a higher level and at a more forward point on that level than in the river-bed skull. Now in all these three points the London skull, while differing from specimens of the modern type, resembles the fossil skull from Piltdown.

In fig. 154 the London skull has been superimposed upon my reconstruction of the Piltdown skull.[1] When we allow for the greater massiveness of the Piltdown skull and the greater thickness of its walls, the agreement in type is very close. The bones of the vault of the Piltdown skull vary in thickness from 10 to 12 mm.; in the London skull the thickness varies from 5 mm. to 7 mm.—the usual thickness of modern skulls. It must be remembered

[1] See fig. 172, vol. ii, p. 515 of *Antiquity of Man* (3rd edition); fig. 100, p. 317 of the 1st edition.

that if we had found only the cranial parts of the Piltdown man we should never have hesitated in regarding him as the direct ancestral type of modern man; the simian features of his lower jaw and of his teeth led us to exclude him from this position. The markings of the Piltdown temporal bone, of the occipital and parietal bones, are essentially as in modern skulls and therein differ from

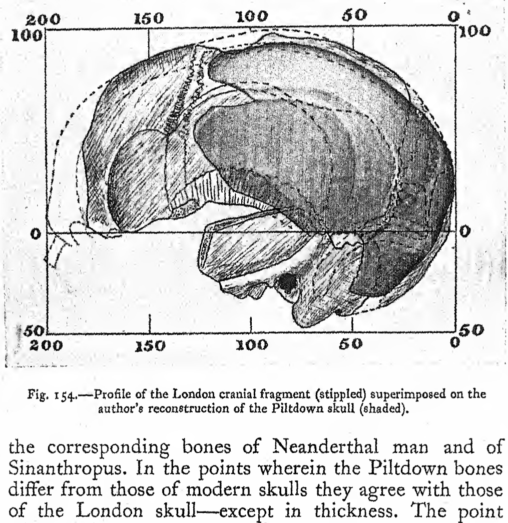


Fig. 154.—Profile of the London cranial fragment (stippled) superimposed on the author's reconstruction of the Piltdown skull (shaded).

the corresponding bones of Neanderthal man and of Sinanthropus. In the points wherein the Piltdown bones differ from those of modern skulls they agree with those of the London skull—except in thickness. The point wherein the London and Piltdown reconstructions differ lies in the position which has been given to the lambdoid suture in my reconstruction of the Piltdown skull. In this reconstruction the lambdoid suture has not been placed far enough back.[1]

[1] See *Antiquity of Man*, vol. ii, p. 547.

In fig. 155 is reproduced an occipital view of my reconstruction of the Piltdown skull[1]; in fig. 156 is given a corresponding view of the London skull, set within the same standard of lines, so that a comparison of their respective dimensions and shapes may be made. The Piltdown skull is represented as 150 mm. in width; that of the London skull as 140 mm., but the actual brain cavity is approximately of the same width in both, namely 136 mm.—the greater width of the Piltdown skull being due to the thickness of its bony walls. Even

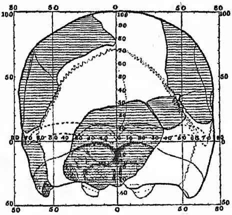


Fig. 155.—Occipital view of the author's reconstruction of Piltdown skull (shown in fig. 154) for comparison with corresponding view of London skull.

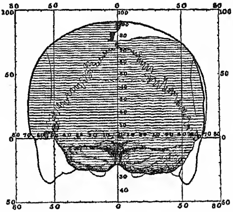


Fig. 156.—Occipital view of London skull set on subcerebral plane, for comparison with Piltdown skull.

when we make allowance for the thickness of the vault, the skull height and brain height of the Piltdown individual are the greater. As regards the shape of the various bones and the muscular and other impressions which are to be seen on them, the correspondence is close, closer than when we compare the London skull to any other type.

Thus when we compare the known parts of the Piltdown and of the London skull we find a remarkable series of agreements, which certainly suggest that there is a closely evolutionary connection between them. The one point in which they differ is in the thickness of their

[1] See *Antiquity of Man*, vol. ii, p. 517, fig. 174.

cranial walls. Thickness of vault, such as we find in the Piltdown skull is certainly primitive, but in fragments of other Piltdown skulls[1] the thickness is not so great as in the original. We have also to consider the influence of sex; in the La Quina (Neanderthal) woman the skull is scarcely so thick as in the London skull. In former

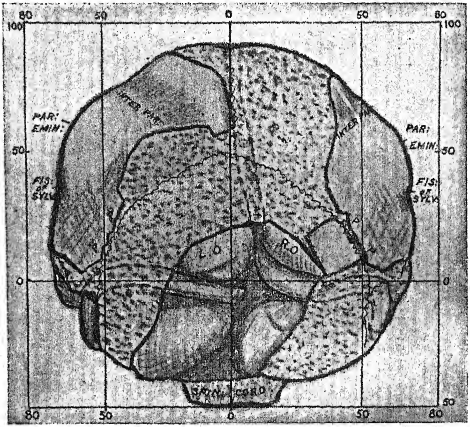


FIG. 157.—Occipital view of the endocranial (brain) cast of the Piltdown skull —the restored parts being stippled.

editions I have expressed some hesitation as to the sex of the Piltdown individual, inclining rather to the point of view that it was female,[2] but with a very distinct female of the same type before me I am strongly inclined to regard the original Piltdown skull as representing the male sex of its species and that some of the differences which distinguish the Piltdown from the London types are sexual in nature.

[1] See *Antiquity of Man*, vol. ii, pp. 592, 594.

[2] *Ibid.*, pp. 594, 604.

Before we discuss the relationship of the London type (*Homo londonensis*) to the Piltdown type (*Homo piltdownensis*) and the place of each in the phylogenetic tree, let us look at certain other features which are revealed on their endocranial casts—casts taken from their brain cavities. In fig. 157 is reproduced an occipital view of the author's reconstruction of the Piltdown brain cast.[1] There are most definite and clear impressions on the occipital fragment of the skull which tell us that the occipital lobes

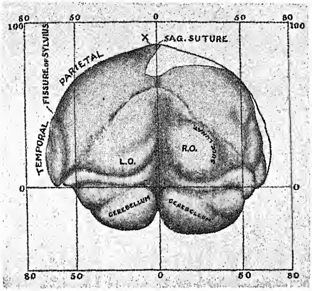


FIG. 158.—Occipital view of the endocranial (brain) cast of the London skull. It is shown oriented on the subcerebral plane.

of the Piltdown brain were highly asymmetrical in their development. As in modern man, the hinder end of the left hemisphere of the brain was much the greater (fig. 157, L, O), pushing over towards and invading the territory of its counterpart on the right side (fig. 157, R, O). As Professor Elliot Smith has proved, this preponderance of the left occipital pole and cortex is symptomatic of right-handedness—of specialization of the right and left hemispheres of the brain for different offices. Asymmetry is not a low or primitive feature—it is the opposite; it indicates an evolutionary advance

[1] See *Antiquity of Man*, vol. ii, p. 628, fig. 228.

towards the modern state. With this asymmetry of the occipital poles of the brain goes a crossed asymmetry of the lobes of the cerebellum—the right lobe predominating.

In fig. 158 is reproduced a corresponding view of the London endocranial cast. Professor Elliot Smith has described the asymmetry of its occipital lobes[1]; in the London woman there is a reversal of the usual arrangement—the right occipital pole preponderating. The London woman, one may infer, was "left-handed". In her the longitudinal blood sinus descended almost in the middle

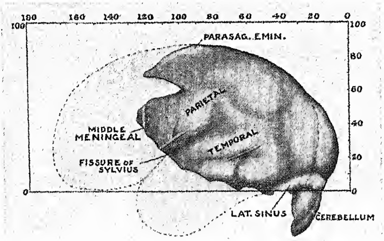


FIG. 159.—Lateral aspect of the endocranial cast taken from the London cranial fragment. It is represented in true profile and on the subcerebral plane.

line of the occipital bone, whereas in the Piltdown individual this sinus was pushed far to the right of the middle line. On the outer aspect of the occipital pole of the London cast can be seen the impression of the lunate (simian) sulcus which marks the limits of that area of the cortex concerned with vision. The right and left cerebellar lobes are separated by a deep and narrow fissure, whereas in the Piltdown brain the separation is shallow and wide. This difference has only an individual significance. If we examine a series of modern skulls we will find that the crest or falx of bone which lies between the two lobes of the cerebellum may be deep and sharp as in the London skull, or low, wide and blunt as in the

[1] *Evolution of Man*, 2nd ed., p. 176.

Piltdown occipital bone. When the occipital outline of the Piltdown brain is examined (fig. 157), a depression will be observed on the lateral aspect of the brain which marks the fissure of Sylvius, the same depression being indicated on the London cast (fig. 158). Below the fissure of Sylvius are the elevations caused by convolutions on the temporal lobe of the brain, which are more developed on the surface of the "London" than on that of the Piltdown brain. On the other hand, the eminence of the parietal lobe, which appears just above the fissure of Sylvius, is more emphasized in the Piltdown than in the "London"

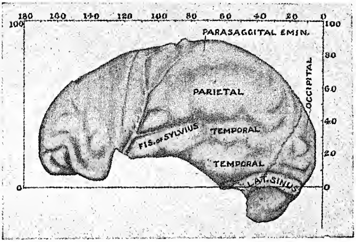


FIG. 160.—The endocranial cast taken from the river-bed skull shown infig. 131.

brain cast (figs. 157, 158). Still higher up, on each side of the middle line, separated by a depression from the parietal eminence, are the parasagittal eminences—the significance of which will be alluded to in the next chapter. These eminences are more prominent in the Piltdown than in the "London" brain cast.

Lastly, to bring our comparison of the London skull with the modern and Piltdown types to an end, let us look at the features revealed on the lateral aspect of the London brain cast (fig. 159). Below the lateral sinus we see the vertical deposition of the cerebellum; above this sinus, but below the fissure of Sylvius (fig. 159), are well marked elevations caused by the convolutions of the

temporal lobe—parts of the brain which we have a right to suppose are connected with the interpretations of sounds—and are therefore concerned in speech and the correlation of speech with vision. These parts are well developed in the London cast. Above the fissure of Sylvius come parietal convolutions, certainly subserving higher functions of the brain, but here less well marked

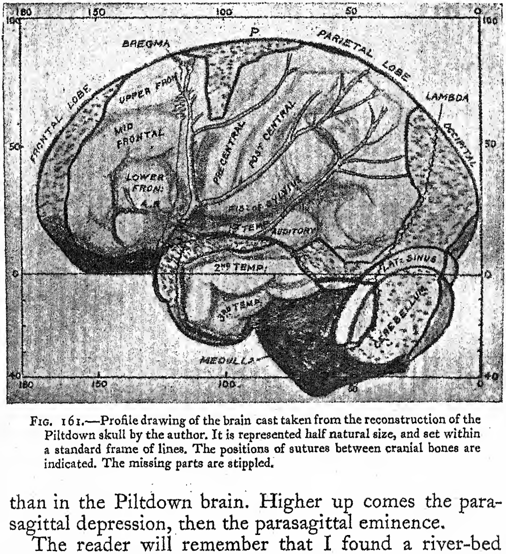


FIG. 161.—Profile drawing of the brain cast taken from the reconstruction of the Piltdown skull by the author. It is represented half natural size, and set within a standard frame of lines. The positions of sutures between cranial bones are indicated. The missing parts are stippled.

than in the Piltdown brain. Higher up comes the parasagittal depression, then the parasagittal eminence.

The reader will remember that I found a river-bed skull (fig. 153) with a close resemblance to the London specimen; the endocranial cast, depicted in fig. 160, is taken from this skull. Here we again meet with the fissure of Sylvius; below the hinder part of that fissure and above the lateral sinus are the same temporal elevations

as are seen on the London skull—only in the modern instances these elevations are more extensive. Above the fissure of Sylvius the parietal convolutions are also more extensive and the parasagittal eminence less marked. Thus the London woman, ancient as she is, has an ample development of those parts of the temporal lobe which we suspect are connected with memory and with speech.

When we turn to the endocranial cast of the Piltdown brain cast which is represented in fig. 161,[1] we see the same vertical position of the cerebellar lobes as in the London cast (fig. 159), but the temporal elevations, between the lateral sinus and fissure of Sylvius, are less emphasized and less extensive. On the other hand, the parietal convolutions above the fissure of Sylvius are more prominent and more extensive than in the brain of the London woman. In the next chapter we shall return to the interpretation of endocranial casts, both ancient and modern, but in the meantime we may state most definitely that there is no feature in the cast of the Piltdown brain cavity, nor in that of the London specimen, which marks the one as being decisively higher or lower than the other, nor is there any feature in either which clearly distinguishes them from brain casts taken from many modern skulls.

Thus by a process of anatomical analysis I have been led to the conclusion that the human skull found in the heart of the city of London, under the foundations of Lloyd's buildings, represents a modification of the human stock first revealed to us at Piltdown in Sussex. The Piltdown and London individuals are separated from each other by a long period of time—which readers will best understand by consulting the provisional calendar of the pleistocene period constantly referred to in this work (fig. 162). Piltdown man was living in what is now the south-eastern part of England when pleistocene deposits began to be laid down. The oldest of the forest-beds of Cromer were then being formed; so were the deepest beds of the 100-foot terrace of the Thames

[1] See *Antiquity of Man*, vol. ii, p. 614, fig. 220.

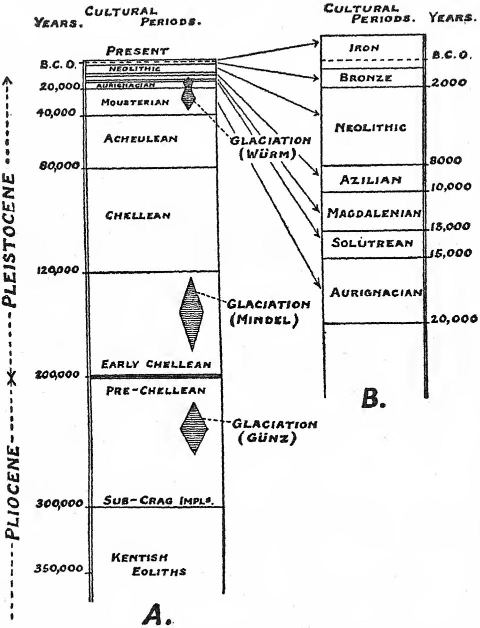


FIG. 162.—Time chart. (A) diagrammatic representation of the pleistocene and pliocene cultural periods and of their duration. The scheme, purely provisional, is that which is adopted in this work. Three glacial periods are depicted. (B) is a magnification of the later cultures shown in (A).

Valley and the high terrace of the Sussex Ouse in which the Piltdown remains were embedded. The climate of Europe was temperate—more so than now—and the earliest forms of Chellean stone tools and weapons were being invented. The London woman and her people lived in the Thames Valley when glacial conditions were setting in. The contorted drifts and deep boulder clay were then being laid down in East Anglia over the Cromerian formations, and also the great gravel bed, which represents the oldest element of the 50-foot terrace of the Thames Valley, was being deposited. The period of Chellean culture was approaching its end and about to pass into another, the Acheulean.[1] Thus the Piltdown race lived at the beginning of the first long temperate interglacial of the pleistocene period. To this interglacial a duration of 120,000 years has been assigned in the time chart reproduced here (fig. 162). The London woman represents English humanity at the end of this long interglacial period.

Is it possible for any type of humanity to exist in one part of the world throughout such a long period of time and remain unchanged? The evidence which is now available leads us to conclude that such a stability is incredible. Mr. A. C. Hinton[2] has made a close study of the fauna which existed in England during the earlier and temperate half of the pleistocene period. He finds no evidence of the arrival of new species by migration during this long period, but ample evidence of the local production of new species by evolutionary change. If this is true of the smaller mammals, may it not also be true of man? May not the crude type which existed at Piltdown in

[1] In my time chart (fig. 162) the first *pleistocene* (Mindel) glaciation is represented as having taken place between early Chellean and Chellean periods of culture; as already mentioned (p. 443), there is a growing body of evidence in favour of assigning this glaciation to the end of the period of Chellean culture. In the deposits at Hoxne Mr. Reid Moir (*Proc. Prehist. Soc. East Anglia*, 1927, vol. 5, p. 152) finds evidence of three pleistocene glaciations—corresponding to the Mindel, Riss and Würm of Penck, but as Chellean implements occur *under* the Mindel and Acheulean *over* the Riss, it is impossible to regard these two as parts of the same glaciation.

[2] See references, p. 444.

Sussex at the beginning of the pleistocene period have become refined into the modified type represented by the London type in mid-pleistocene times? This is what I suppose to have happened; it is the most likely explanation of the facts known to us. Such a supposition raises

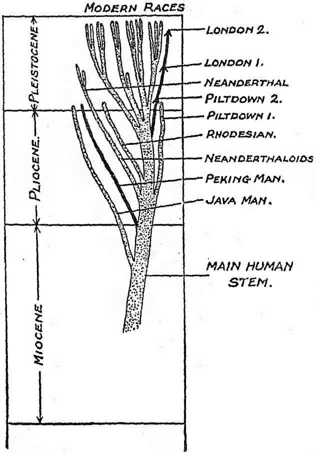


FIG. 163.—The phylogenetic tree of man's evolution showing the position formerly attributed to the Piltdown type (Piltdown 1) and the position the author would now give to that type (Piltdown 2) and to the newly discovered London type (London 1).

issues of the first magnitude relating to the evolution of modern man, issues which are discussed elsewhere.[1]

In conclusion let us ascertain the place which is to be assigned—in the light of the anatomical and geological evidence just discussed—to this strange and ancient London type in the evolutionary tree of humanity. In fig. 163 is reproduced part of the evolutionary tree used in former editions of *Antiquity of Man*. Piltdown man is there

[1] See introduction, p. 32.

represented as springing from the main human stem in the pliocene period and becoming extinct early in the pleistocene period. The objections to placing the Piltdown type in the direct line of the ancestry of modern man are the simian characters of his mandible and of his teeth. These objections are less weighty to-day than they were in 1915 when the first edition of *Antiquity of Man* appeared. We did not know then that in other very early pleistocene types of humanity the canine teeth had assumed—apparently independently—a human shape and size, and that their chin regions were coming by man-like characters. Evidence is accumulating which leads us to believe that similar structural changes may occur in groups of humanity long after their separation from a common ancestor—that, in brief, we must accept "parallelism" as having been a factor in the evolution of human races. It is therefore possible that Piltdown man does represent the early pleistocene ancestor of the modern type of man. He may well be the ancestor we have been in search of during all these past years. I am therefore inclined to make the Piltdown type spring from the main ancestral stem of modern humanity (fig. 163) and to represent this stock as becoming modified in the early pleistocene period so as to culminate later in that period as the London type. If Mr. Hinton is right as to the late age of the London gravels, then the Piltdown line has to be carried up almost to the end of the pleistocene period (fig. 163, London 2). Certain it is that the London skull cannot be assigned to the Neanderthal stock or stem; its anatomical characters are those seen in the skulls of Piltdown and modern types of humanity, but its nearest affinity is to the Piltdown type.

CHAPTER XXXI

THE INTERPRETATION OF BRAIN CASTS

In an expansive moment, when writing the chapters on Galilee man, I promised to return to a consideration of the brain of that ancient individual and to discuss the interpretation of brain casts[1] both ancient and modern. I am now to make my promise good, but I enter on my task with some degree of trepidation. It is difficult to render the evidence drawn from a study of the bones of the skull—the bones which enclose the brain—intelligible to those who have not served an apprenticeship in anatomy; this difficulty is greatly increased when we come to deal with the brain. For beyond a doubt the human brain is the most complex structure in the whole realm of Nature. Further, our knowledge of the brain is not what it yet will be; we have made only a beginning. We have gone far enough, however, to be certain that man is what he is because of his brain; his peculiar foot, his deft hand and his upright posture are but human accessories. The central problem of man's evolution is the rise of his brain in size and in complexity. We know the mental manifestations of modern man; we know the size and convolutionary pattern of his brain; we have reason to believe that these two aspects of his brain—the structural and psychological—are interdependent. We proceed in our interpretation of brain casts of fossil man under the belief that the nearer they approach to those of modern man in volume and in convolutionary pattern the nearer their owners were to us in feeling, thinking and doing. On the other hand, the more such casts approach those taken from the skulls of anthropoid apes the more, we presume, was their mentality akin to that of a lower order of beings. Thus, difficult although it is to give a simple account of the brain, the task of inter-

[1] Endocranial is the proper name to give to a plaster cast taken of the interior of a skull, but as such casts provide a basis for the study of the brain it is convenient to speak of them as "brain casts".

preting brain casts is one which cannot be avoided by an author, and has to be faced by those who desire to follow advances which are now being made by those who are deciphering the mentality of the earlier races of mankind.[1]

When a cast is taken from the interior of a modern

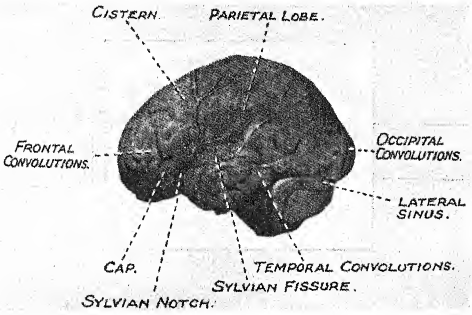


FIG. 164.—Photograph of a brain cast taken from the skull of a modern European. (J. H. McGregor.)

skull, in only two areas are the convolutions of the brain clearly marked: (i) over the anterior and lower part of the frontal lobe (fig. 164) and (ii) over the greater part of

[1] I would here draw the reader's attention to studies which Dr. Ariëns Kappers of Amsterdam has made recently of brain casts of extinct races of mankind:—

(i) "The fissures on the frontal lobes of Pithecanthropus compared with those of Neanderthal men, *Homo recens* and Chimpanzee", *Proc. Roy. Acad. of Science Amsterdam*, 1929, vol. 32, No. 2.

(ii) "Further communication on the fissures of the frontal lobes in Neanderthal men", *ibid.*, 1929, vol. 32, No. 2.

(iii) "The frontal fissures on the endocranial cast of some Predmost men", *ibid.*, 1929, vol. 32, No. 5.

(iv) "The influence of cephalization co-efficient and body-size upon the form of the forebrain in mammals", *ibid.*, 1927, vol. 31, No. 1.

In this connection must also be mentioned the standard work on this subject by Dr. Tilly Edinger, *Die Fossilen Gehirne*, Berlin, 1929. To this I would add: Dr. Eugene Dubois's original monograph, "On the endocranial cast of

the temporal lobe; in these two areas convolutions and fissures are sharply outlined. In two other areas the convolutionary pattern is discernible but less distinctly: in the hinder or occipital region of the brain—areas connected with vision—and over the lower part of the parietal lobe, just over the fissure of Sylvius (fig. 164)—areas of uncertain significance. It is fortunate for our present purpose that the two areas which are sharply defined are those in which the human brain has undergone its most characteristic evolutionary expansions.

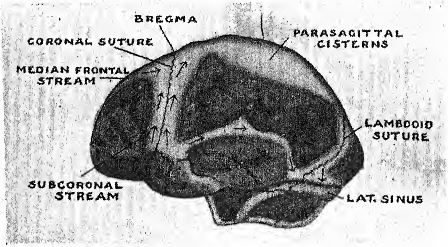


FIG. 165.—Brain cast showing the "stream lines" (flumina) by which the cerebro-spinal fluid ascends from the base to the convexity of the brain.

Both areas subserve those faculties which lift man above the denizens of the jungle, giving him his power to compare, to discern, to understand, to think and to speak. Especially have we reason to believe that the lower part of the frontal lobe—the third frontal convolution—is in some way concerned in the power to give utterance to thought.

Why is it that only certain areas of the brain surface

Pithecanthropus", with its excellent illustrations (*Proc. Roy. Acad. of Science Amsterdam*, 1924, vol. 27, Nos. 5, 6; Professor G. Elliot Smith's "New Light on Vision", *Nature*, 1930, vol. 125, p. 820); references to other papers by this author will be found in various parts of *Antiquity of Man*. My description of the Galilee brain cast, its comparison with other fossil casts and references to important papers on the brain, will be found in *Researches in Prehistoric Galilee*, London, 1927.

come in close contact with the bony walls of the skull and so leave a distinct impress reflected on casts taken from them? It was not until 1925 that our knowledge was sufficiently advanced to make an explanation possible. By this date the researches of Professor Louis Weed[1] and of Professor Harvey Cushing[2] had led us to realize that the fluid which bathes the brain—the cerebro-spinal fluid—is continuously streaming from the base and

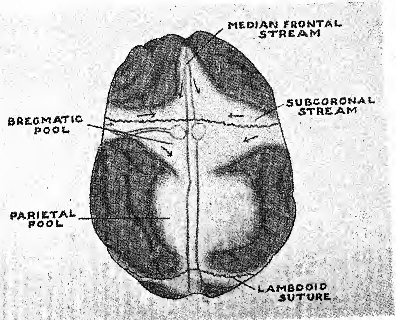


FIG. 166.—Upper or vertical view of a brain cast on which the stream-beds and pools occupied by the cerebro-spinal fluid are depicted.

interior of the brain, where it is secreted, to the upper surface or convexity of the brain, where it is absorbed. There are two main pathways by which the fluid ascends from the base to the upper surface of the brain (fig. 165). One ascends beneath and near the coronal suture—the subcoronal stream, beginning below in the Sylvian depression or notch and ending above in a bregmatic pool or cistern. The other ascending stream—the median frontal—emerges between the right and left half of the brain at the position shown in figs. 165, 166. The fluid

[1] *American Journ. of Physiol.*, 1919, vol. 48, p. 531.
[2] *Lancet*, 1925, vol. ii, p. 851.

ascending or percolating along these streams[1] flows into pools or shallow cisterns situated under the vault of the skull, where absorption takes place. There are two main pools on each side of the middle line—the bregmatic and parietal (fig. 166). Besides these main streams and pools there are minor ones, such as the Sylvian, which passes along the brain fissure of that name to end in a pool above the lateral sinus (fig. 165), and another which lies under the lambdoid suture (figs. 165, 166).

I am offering my readers a new explanation of two appearances with which they may be already familiar: (1) why evolutionary markings are not apparent all over a brain cast but are confined to certain areas (see fig. 164); the areas devoid of impressions are those which are "blanketed"—separated from the bony wall of the skull—by streams and pools of fluid; in other areas, such as the frontal and temporal, convolutions are in direct contact with the containing bony walls and therefore leave their impress on them. (2) The other matter which I wish to explain concerns certain features which my readers must have observed on the bald crowns of us elderly men. Some of these features are illustrated on the outlines of two heads, one being taken from Orpen's sketch of Landru the arch-criminal (fig. 167, A). The distinct boss or elevation in the bregmatic region of the vault is caused by an uncommon development of the bregmatic pool; on the side of the head is a wide vertical groove—the post-coronal depression. The elevation in front of this depression is caused by a particularly well-developed subcoronal stream or flumen. The post-coronal depression is a consequence of the coronal elevation. Further, when such a head is looked at in full face, a median elevation or crest is seen to commence on the crown, just above the forehead, and to expand as it passes backward to join the bregmatic elevation. This median

[1] The brain is wrapped within a semi-transparent covering—the arachnoid membrane. The cerebro-spinal fluid flows or percolates in spaces under this membrane—in the sub-arachnoid spaces. The streams and pools make impresses on the overlying bony walls of the skull and are thus reproduced on brain casts.

frontal ridge and bregmatic eminence are particularly noticeable in certain ancient skulls, particularly those of Pithecanthropus, Sinanthropus, Rhodesian man, Chancelade man and many others—skulls which are often described as "ill-filled". In the second illustration (fig. 167, B) it will be seen that the hair still persists in the depression which lies behind the coronal elevation and that the eminence caused by the parietal pool is particularly prominent. So far as is known, there is no correlationship between prominence of cerebro-spinal spaces and mental ability.

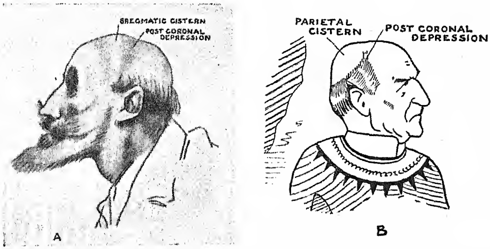


FIG. 167.—(A) Profile of Landru (after Orpen). (B) Profile of an English statesman.

Thus, on a brain cast taken from a fossil skull, we can trace the development and form of three sets of structures: (1) of certain convolutionary areas of the brain; (2) of elevations produced by sluggish streams and pools of cerebro-spinal fluid; (3) of certain blood vessels—arteries and venous sinuses. All the impressions preserved on a cast taken from the interior of a skull help the anatomist to interpret the potentialities of the brain which lay within it. In this way light is thrown on the mentality of early man. Even the size of the blood sinuses has a significance.[1]

[1] Professor M. R. Drennan has made an estimate of the volume of the brain of Piltdown man based on the size of the lateral blood sinuses, *Nature*, 1927, vol. 120, p. 874. His estimate is 1430 c.c.

The size and sharpness of differentiation of the subarachnoid streams and pools are not usually found on elaborately convoluted brains of large volume; the opposite is the case; they are most clearly seen in smaller and simpler human brains. They are exceedingly distinct on the brain casts of the Java man, of Rhodesian man and on most impressions taken from Neanderthal skulls. On the other hand, the cerebro-spinal streams and pools are diffuse and ill-marked on casts taken from the skulls of anthropoid apes, and again—in many casts taken from modern skulls—where the cerebro-spinal streams are diffused over wider areas and the pools under the vault are less deep. Still, their presence in the lower and earlier types of humanity is of great interest, for I have reason to think that these cerebro-spinal spaces are part of a mechanism which is used by the growing brain to obtain expansion of the skull.

It is a particularly fortunate circumstance for us who are seeking to unravel the early history of mankind that the convolutionary areas which are usually preserved on brain casts represent regions of the brain which have undergone great expansion in the later evolutionary stages of man's advance. This is more especially the case in the frontal region, and in my present survey we shall confine our discussion to this region. The time will come, however, when the temporal, occipital and supra-Sylvian regions will contribute their quota to our knowledge of the mental equipment of early man.

I am restricting my discussion to the frontal region for this reason. Readers will remember that only the front part of the Galilee skull was found; a cast taken from it gave a true reflection of the convolutions and sulci of a large part of the frontal lobe of that ancient individual. My inquiries led me into a study of the convolutionary pattern to be seen in the frontal region of brains ancient and modern, and it is a résumé of these observations I propose to give here.[1]

[1] The reader will find a more detailed account in *Researches in Prehistoric Galilee*, 1927, p. 93.

When we view the Galilee brain cast in full face (fig. 168), we see that the convolutions are hidden in the upper parts of the frontal lobes by the median frontal streams (f, f) which emerge between the hemisphere, by the bregmatic pools (g, g), and by the subcoronal streams (h, h, h, h) ending in the bregmatic pool (g, g). On the exposed areas are seen the outlines of the frontal convolutions—the upper (a, b, c, d), the middle (e, e) and the inferior. Now all we are certain of at the present

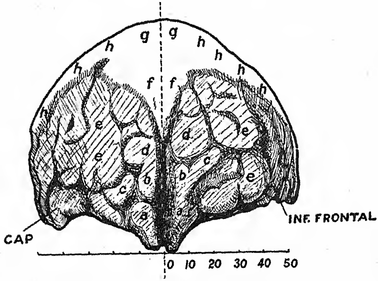


Fig. 168.—Drawing of the cast taken from the frontal bone of the Galilee skull. It has been set on the subcerebral plane and drawn from the front. Further explanation in the text.

moment is that the three frontal convolutions have undergone a great expansion during human evolution. Certain areas of cortex, already present in the frontal lobes of anthropoid brains, have increased amazingly in the higher races of mankind. We have reason to suspect that such areas are somehow connected with the control which man has obtained over his movements and actions and with his powers of attention. In the Galilee brain the frontal convolutions attain a fair degree of development; we may infer that the mentality of its owner was higher than the bestiality of the supra-orbital ridges of the skull itself leads us to suspect.

How the frontal lobes of the Galilee individual compare with those of early and recent types will be seen from the following measurements. If we take the width of the cast, between the most prominent points of the inferior frontal convolutions we find it to be 105 mm.; the height, taken from the surface which rests on the small wings of the sphenoid to the region of the bregma, is 88 mm. Now the same dimensions, taken on a gorilla's brain cast,

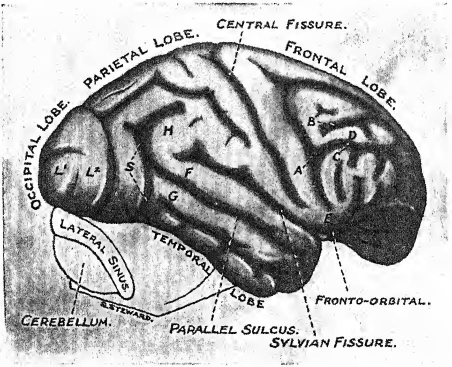


FIG. 169.—The lobes and fissures on the lateral aspect of an adult chimpanzee's brain. E, Orbital cap (further explanation in text).

are: width 83 mm., height 55 mm.; in the brain cast of Pithecanthropus the width is 91 mm., the height 70 mm.; in the Rhodesian brain cast the width is 103 mm., the height 83 mm.; in the Gibraltar brain cast the width is 108 mm., the height 77 mm.; a brain cast taken from the skull of an Australian aboriginal woman gave a width of 99 mm. and a height of 91 mm. Thus, in point of frontal development the brain of the Galilee woman reached a level equal to that of the lowest races of to-day—and yet in physical appearance the Galilee type differed profoundly from the modern type.

We are now to turn to a study of certain features which are recognizable on the lateral aspects of brain casts and to trace, very briefly, a series of remarkable evolutionary changes which affected one area of the frontal lobe. To follow my argument the reader must glance at the chief markings of the chimpanzee's brain (fig. 169) and note that the fissure of Sylvius has below it the temporal lobe, above it the frontal and parietal lobes. The central fissure descends towards the fissure of Sylvius and separates the frontal lobe from the parietal. Just in front of the lower end of the central fissure, and above the beginning of the Sylvian fissure, the inferior convolution of the frontal lobe swells into a rounded eminence to which Professor Anthony gave the convenient name of "frontal cap". No matter what brain cast we look at, be it taken from the skull of man, ape or monkey, we cannot fail to recognize the frontal cap. It always occupies the same position in the skull, lying over the orbital roof and abutting against the side wall of the frontal bone. When we look at the brain of any of the higher primates we find: (1) that the hinder end of one of the frontal fissures—the arcuate—always descends towards the cap (fig. 169, A); some distance in front of the cap (E) a fissure emerges from the orbital surface—the fronto-orbital fissure (fig. 169). Between the fronto-orbital fissure and the cap there is an area of cortex—more or less submerged—the orbital operculum. Under, and partly hidden by, the cap is a submerged lobe of the brain—the Island of Reil. Now the chief of the evolutionary changes which transformed an anthropoid into a human brain was centred in and round the frontal cap. On the brain casts taken from fossil human skulls we can decipher the later stages of the transformation.

The reader will grasp the nature of the changes in which the frontal cap was involved by comparing the two drawings reproduced in fig. 170. "A" represents the lateral aspect of the front half of a chimpanzee's brain; "B" the corresponding parts of that of an Ulsterman. In order to make the comparison easy the chimpanzee's

brain has been increased above its actual size (see scale). The cap is very evident in the chimpanzee's brain; it forms a loop-like convolution a′, a, b, round the lower and hinder end of the arcuate fissure (fig. 170, A, arc.). In front of this convolutionary loop ascends the fronto-orbital fissure (f.o.). In the human brain (fig. 170, B) the cap has undergone an enormous expansion. The loop can still be recognized (a′, a, b). The area of the cap has been extended downwards and forwards on the orbital surface of the frontal lobe carrying before it the fronto-orbital

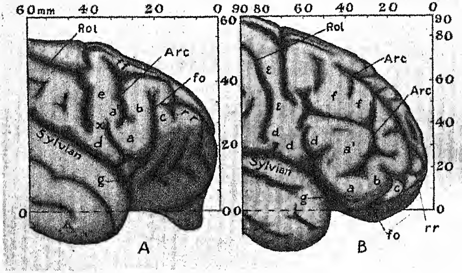


FIG. 170.—(A) The frontal region of the brain of a chimpanzee, drawn one-third above natural size. (B) The corresponding region of the brain of a European—drawn natural size. Explanation in the text.

fissure (f.o.) and squeezing that fissure on to the orbital surface of the brain. At the same time there has been a great expansion forwards in the Island of Reil, a prominent lip or operculum (g) to the island has developed behind the fronto-orbital fissure; the anterior end or pole of the temporal lobe has shared in the general expansive movements. We see that the small areas above and behind the arcuate fissure in the chimpanzee's brain (f, f) have become extensive areas in the human brain (f, f), assisting in the displacement of the lower frontal convolutions in a downward and forward direction.

The arcuate fissure in the chimpanzee's brain, on leaving the cap or loop, passes forwards on the frontal lobe, ultimately ending in or near another fissure (r, r) which represents the straight fissure of the monkey's brain. The forward part of the arcuate fissure and a remnant of the straight fissure are recognizable on the human brain (fig. 170, B, arc. r, r).

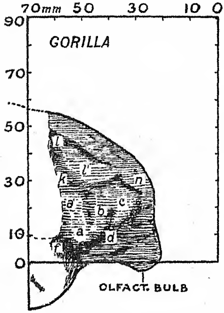


FIG. 171.—Lateral aspect of that part of a gorilla's brain which is covered by the frontal bone. From a brain cast. a, a', b, cap; d, fronto-orbital fissure; c, convolution in front of fronto-orbital; f, fissure of Sylvius; k, pre-central fissure; l, upper frontal sulcus; l', middle frontal convolution; n, upper frontal.

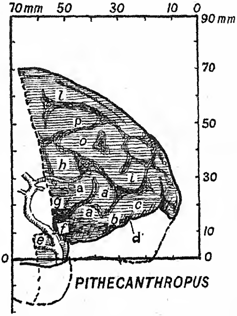


FIG. 172.—Corresponding part of the brain cast of Pithecanthropus. The corresponding convolutionary areas are indicated by the letters used in the adjoining figure of the gorilla's brain.

How much the lowest known human stage, in the transformation of the frontal region, rises above the highest known anthropoid stage becomes manifest when we compare, as has been done in figs. 171 and 172, the brain of Pithecanthropus with that of the gorilla. In fig. 171 that part of the brain which is covered by the frontal bone is depicted; in fig. 172 is shown the corresponding region of Pithecanthropus—both taken from brain casts. Both are drawn to the same scale; the superi-

ority in size of the human specimen is manifest. In the gorilla the frontal cap forms a simple loop (a′, a, b); the arcuate fissure emerges from the loop and passes forwards on the frontal lobe, below n. The fronto-orbital fissure is seen at d. In the brain of Pithecanthropus the orbital region is missing, but it is apparent that the frontal cap was situated at a higher level than in modern

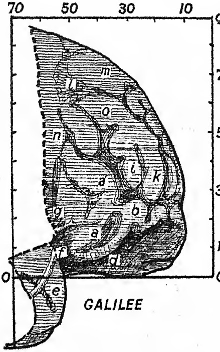


FIG. 173.—The brain cast of the Galilee skull, seen in true profile, and oriented on the subcerebral plane. The area is that covered by the frontal and sphenoid bones.

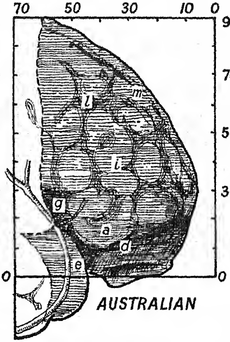


FIG. 174.—Corresponding areas of a brain cast taken from the skull of an Australian aboriginal woman. Explanation in text.

brains and that the orbital surface was more exposed than in them. The cap has become a complex structure and the arcuate fissure has undergone subdivision. Nevertheless, I think the frontal cap or loop is represented in fig. 149 by a′, a, a, b. The termination of the fronto-orbital fissure is marked at d. The arcuate fissure is continued forward below o, i. In the brain of Pithecanthropus we have a simple but complete representation of all the convolutionary areas of the frontal lobe of a human brain; the fissure of Sylvius (f), shallow in the gorilla, has become

deep in Pithecanthropus, owing to outgrowths from the adjacent frontal and temporal regions. Clearly, between the stage represented by the gorilla and that revealed in the brain of Pithecanthropus, there must be many stages of which we have found no trace as yet. Nor can we expect to find such missing stages until late miocene and early pliocene deposits of tropical regions of the earth have been searched.

In figs. 173, 174, further stages in the evolution of the frontal region of the human brain are represented. In size and in mass of convolutions the Galilee brain stood well above that of the Java fossil man. The area of the cap had expanded farther forwards and downwards, thus covering and obscuring the orbital surface. Although the cap area of the Galilee brain (a′, a, b) was nearly twice the size of that of Pithecanthropus, yet the arrangement of sulci and the manner in which the arcuate fissure has become broken up are very similar in these two human types—separated widely as they were in time and space. In the brain cast of the Australian woman we see that the frontal convolutions are more massive, the Sylvian fissure (depression g) has become deeper, owing to a greater degree of expansion in the neighbouring frontal and temporal regions; in both we detect the fronto-orbital fissure (d) underlying the cap. With such a degree of resemblance in anatomical details in the frontal region of the brain we may presume that the mentality of the ancient Galilean was not materially different from that of the aboriginal Australian.

In treating of these matters I have touched but lightly on the technical features which chiefly concern anatomists.[1] All that I have sought to make clear to my readers is that we have reason to hope, by the study of brain casts, to find a way of estimating the mental status of beings, human and semi-human, although they have been dead for 100,000 years or more. I admit that we

[1] Those desiring to make a closer acquaintance with the methods applied to the study of brain casts and with the results so far obtained, should consult the works mentioned on p. 469.

are not yet in a position to do so, for we are still ignorant of the functional meaning of many parts of the human and anthropoid brain. A century ago men would have laughed to scorn the idea that astronomers might ultimately determine the chemical composition of the most distant stars; the discovery of the spectroscope made such analysis possible. When we have found the Rosetta stone which gives us a key to the hieroglyphics of the brain, we shall be in a position to analyse the mentality of those ancestral forms known to us at present only by fragmentary fossil skulls.

It is not necessary here to discuss the significance of size of brain, nor of complexity of convolutions; these problems of the brain have been touched on in many parts of this work.[1] All of us have found, from practical experiences, that size and shape of head are uncertain guides to the mental capacity of men and women. Even with the brain exposed before him, with all its convolutionary details under his eye, the anatomist hesitates to venture an opinion as to the abilities which had been resident in the living organ. Yet it may be that our failure lies not in our anatomical observations, but in our psychological estimate. The criterion of ability or capacity which we apply is one founded on the needs of an economic world. The brain which answers best to the needs of such a world as ours now is may not be the one which answered best under other conditions of life. Primarily, I suspect that a large brain was given to man, not that he might understand life, or circumvent difficulties, but simply to enjoy it. To assess the value of any given brain for this purpose is not an easy task.

[1] See index to vols. i, ii of *Antiquity of Man,* and index of present volume under "Brain, capacity of", "Cranial capacity" and "Endocranial casts".

CHAPTER XXXII

THE PROBLEMS RAISED BY THE DISCOVERY OF *HOMO GARDARENSIS*

Gardar, where the fragmentary remains of *Homo gardarensis* were unearthed, lies near the southern point of Greenland (fig. 175). The Norsemen who took possession of Iceland in the ninth century began, about a hundred years later, to establish colonies or settlements

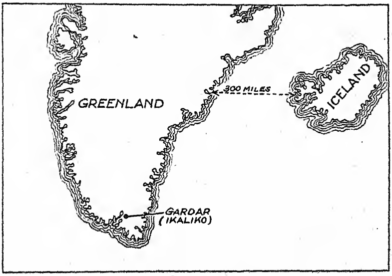


Fig. 175.—Sketch map of the southern part of Greenland, showing the position of the modern Ikaliko, and the ancient Norse site of Gardar.

along the west coast of Greenland. By the twelfth century the Norse settlement at Gardar—in the modern district of Ikaliko—had so prospered that it built itself a Cathedral and buried its dead in a neighbouring churchyard. In 1926, when an archaeological expedition sent out by the National Museum of Copenhagen visited the locality, Gardar had become a memory; it had to be searched for with the spade. In the course of excavations the old burial place was opened; about fifty graves were examined. In one was found the remains of a bishop, with his staff by his side and his gold ring on the bones of his finger. The men and women found in the other graves—all of the twelfth century—were the descendants

of the Vikings. Some of the men buried in these graves had strongly built bones and skulls. In one grave was found a lower jaw so massive that it caught the attention of the excavators; this jaw, with a part of an equally massive skull from the same grave, and also skeletons from adjacent graves, were retained and duly carried to Copenhagen, where they were deposited in the laboratory of Professor F. C. C. Hansen early in 1927. The massive piece of skull and the lower jaw, Professor Hansen observed, were in the same state of preservation as the other bones. They were parts of a man who lived at Gardar in the twelfth century and was buried there in a Norse churchyard, under the shadow of the Cathedral.

Professor Hansen, on examining the fragment of skull and lower jaw, saw they were parts of the same individual —a man—and that both showed in an extreme degree characters which mark human skulls of an ancient type, such as the La Chapelle and Rhodesian skulls. Seeing that Gardar lies within the territory of the Eskimo, one of the most primitive, in a structural sense, of all modern races of mankind, the suspicion may have already crossed the reader's mind that the anomalous fragments which reached Professor Hansen may have been part of an exceptional Eskimo who had somehow come to rest amongst the Norsemen buried in the ancient cemetery of Gardar. Fortunately Professor Hansen is an authority of all that pertains to the Eskimo of Greenland; he is joint author of a standard treatise on the people.[1] In his opinion the cranial fragments were devoid of all Eskimoid traits; he ascribed them to an ancient Norseman who, by some freak of inheritance, had suddenly reverted to an early stage of human evolution.

Having made a minute study of the fragments and reconstructed the skull of which they had formed part, Professor Hansen published in 1929 a preliminary account of the discovery made at Gardar in a Sunday

[1] *Crania Groenlandica*, by Professor C. M. Fürst of Lund and Professor F. C. C. Hansen of Copenhagen, 1915.

newspaper,[1] reproducing an accurate drawing of his reconstruction. To the type of man represented by the skull he gave the name *Homo gardarensis*. He was good enough to send me a copy of the newspaper; I was at once impressed by the accuracy of the drawing and the remarkable characters of the skull. It is to this drawing

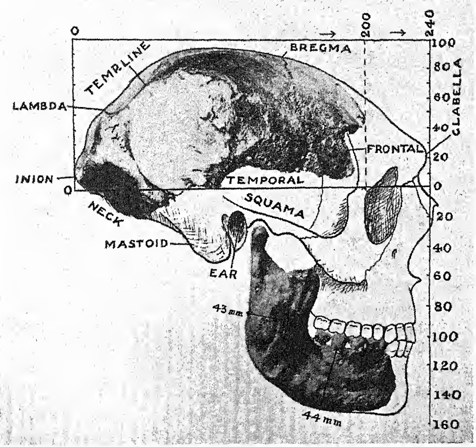


FIG. 176.—A reproduction of Professor Hansen's drawing of his reconstruction of the skull of *Homo gardarensis*. On this drawing I have indicated the sub-cerebral plane and erected on it a framework of lines, 100 mm. high and 240 mm. long in place of the usual 190 mm. The reconstructed parts are indicated in outline.

we are now to give our attention; it is reproduced in fig. 176. Fortunately for me, Professor Hansen had reproduced his drawing half natural size, so that I was in a position to erect on it the framework of lines employed in this work (fig. 176). The skull, as reconstructed, proved

[1] *Berlingske Tidende*, June 23, 1929.

to be of enormous length (238 mm.); to contain it I had to make the parallelogram 240 mm. long; the vertical at 200 mm. (fig. 176), which usually cuts the glabella of the larger palaeolithic skulls, in this case was just sufficient to contain the part of the skull actually found. On the other hand, the vault of the skull was remarkably low in pitch, rising only 93 mm. above the subcerebral plane and only 82 mm. above the plane (glabella-inion) employed by Professor Schwalbe. Thus the Gardarene skull, like those of Neanderthal and Rhodesian men, was very long and low. Further, it was stamped with primitive marks: the bony attachment for the neck was enormous, the inion projected backwards to an extreme degree, the lambda was low in position; the lines which mark the upper limits of the temporal muscles almost met along the middle line of the vault, as in the female gorilla. The lower jaw was such as I had never seen before in any kind of skull, human or anthropoid, so massive was it.

When I had made an examination of Professor Hansen's drawing and enlarged it to natural size, I went to my portfolios where my skull records are kept. It was not in the palaeolithic portfolios I found the nearest approach to the remarkable Gardarene specimen, but in those where I had stored records of these remarkable disorders of growth known as acromegaly and giantism.

About the year 1910 my attention had been drawn, by a fortunate accident, to the manner in which the skulls of men who had suffered from acromegaly mimicked the skulls of Neanderthal man.[1] When Huxley published his account of the Neanderthal skull, Dr. Barnard Davis, a well-known craniologist of the mid-Victorian era, drew attention to a modern skull in his possession which manifested all the primitive features detected by Huxley in the skull from Neanderthal. As the cast used by Huxley and the skull mentioned by Dr. Barnard Davis were in the Museum of the Royal College of Surgeons, I com-

[1] The reader will find a record of my studies under the references given in vol. ii, p. 385 of *Antiquity of Man*. Huxley's description appeared in *Man's Place in Nature* (1863).

pared them and was impressed by their general resemblances. I found in the Barnard Davis skull that the fossa for the pituitary gland was enlarged and that its characters were due to acromegaly. By 1910 it was well

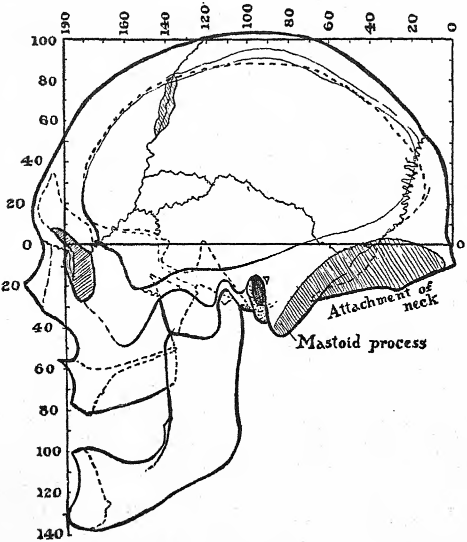


FIG. 177.—The skull of an Englishman who suffered for many years from pathological enlargement of the pituitary gland.

known that the growth of the human body was co-ordinated and controlled by substances—hormones—secreted by certain glands of the body, the chief of these being the pituitary. Acromegaly revealed one of the growth mechanisms of the human body. I came to the conclusion then which prolonged observation has gone to confirm, that the cranial and facial features of primitive

man and those of acromegalic men and women are of the same nature—only in primitive man they were produced by a normal or physiological action, whereas in the acromegalic they are the result of an abnormal or pathological action.

I reproduce here, in fig. 177, the drawing of an acromegalic skull which illustrates my description of the Rhodesian skull.[1] This acromegalic skull has certain resemblances both to the Rhodesian skull and to the Gardarene skull. From the following passages written in 1924[2] the reader will see that I anticipated the possibility of an acromegalic skull being mistaken for that of an early type of man. "From these figures the reader will learn that (in Acromegaly) all parts of the face undergo growth and become enlarged—the forehead, the orbits, the nose, the cheeks, and the jaws. He will note, too, that these changes are gross imitations of the features we have just been studying in the face of Rhodesian man. . . . There still lurks in the body of modern man the machinery which fashioned the ample features of Rhodesian man and which can be awakened under conditions of disease. It is the same machinery which determines the more exaggerated degree of bestial strength seen in the face of the gorilla."

Having recognized acromegalic traits in the Gardarene skull, I wrote to Professor Hansen and laid my conclusions before him. He replied that he was familiar with my writings on acromegaly, but after full consideration he was persuaded that the regular proportions seen in the jaw and cranial bones of the Gardarene skull and the harmony of all its features could not be explained as a pathological manifestation of growth such as occurs in acromegaly. He was convinced that in the isolated Norse colony at Gardar there had been born an individual in whom an inheritance, derived from a remote ancestry, had suddenly become manifest, reproducing in the twelfth century the features of early man. Several other Norse skulls from the same cemetery also presented

[1] See *Antiquity of Man*, vol. ii, fig. 148, p. 415. [2] *Ibid.*, pp. 412–415.

primitive traits of a similar kind but in a lesser degree. From the inbreeding of this stock there had issued, Professor Hansen believed, an atavistic reproduction of early man. To convince me that his interpretation was the right one, Professor Hansen, although he had not published his full report, sent me his measurements and a series of excellent photographs and drawings of all aspects of the Gardarene skull.

As Professor Hansen attaches particular importance to the lower jaw, let us look first at its remarkable features. In fig. 178 the large mandible of an Australian aborigine has been superimposed so that the three molar teeth of the one coincide with the corresponding teeth of the other. The length (medio-distal) of the three Gardarene molars is 35 mm.—which is equal to molar measurements of many palaeolithic skulls, but is also not greater than does occur occasionally in the dentitions of modern Europeans. The teeth decrease slightly in size from the first to the third; the arrangement of cusps is such as may still be found amongst modern Europeans. Unfortunately the region of the chin and the front teeth—canine and incisors—are missing from the Gardarene jaw, and in restoring the incisor teeth Professor Hansen has made too liberal an allowance. The canine and incisor teeth when seen in true profile rarely make up more than 10 mm.—often less—of the dental length of palaeolithic jaws, whereas Professor Hansen has added 16 mm. to the Gardarene dental length. The length of the dental arcade of the Australian represented in fig. 178 is 58 mm.; the length in the Gardarene specimen was some 2 mm. more—about 60 mm. Such a length, common in early

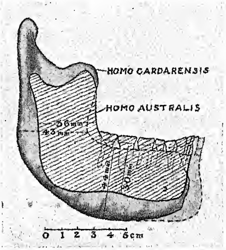


FIG. 178.—The lower jaw of an Australian aborigine superimposed on the Gardarene mandible.

palaeolithic men, is rare in modern Europeans. How much the bony framework of the Gardarene mandible exceeded that of the Australian is apparent from fig. 178. The depth of the body of the mandible, at the second molar tooth, is 30 mm. in the one and 44 mm. in the other. The ascending ramus, which by its extent indicates the development of the muscles of mastication, is overwhelmingly the larger in the Gardarene specimen; at its narrowest the ramus measures 43 mm., an amount we find in the larger Cromagnon jaws, and exceeds the Australian jaw by 7 mm. (fig. 178). The lower jaw makes up a large part of the human face; how massive was the face of Gardarene man may be inferred; Professor Hansen, in his restoration (fig. 176) has represented the total length of the face as 165 mm., 40 mm. longer than the face of the average Norseman.

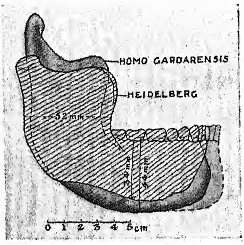


FIG. 179.—Profile of the Heidelberg jaw superimposed on the Gardarene mandible.

In fig. 179 the Heidelberg jaw has been superimpcsed on the Gardarene specimen so that the molar teeth correspond. The Gardarene incisors are seen to project in front of the Heidelberg teeth, but a truer restoration of parts makes the dental length of the two nearly alike. In its dental length, as Professor Hansen insists, the Gardarene jaw equals or even outdoes that of one of the earliest and most primitive forms of mankind. The ascending ramus of the Heidelberg jaw is 9 mm. wider than the Gardarene ramus, but the condyle of the latter rises 25 mm. above the Heidelberg condyle. An excess in height of the ascending ramus, as we shall see, is indicative of acromegaly. As regards depth of body, the Gardarene mandible exceeds the Heidelberg by 10 mm.

Of all the specimens at my disposal the mandible which

most resembles the Gardarene jaw is the mandible of O'Brien, the young Irish giant. His stature was 7 ft. 8·4 in. (2·358 m.); he died in 1783, when only 22 years of age. The molar teeth are superimposed in fig. 180, and they agree closely as regards their dimensions and arrangement of cusps. The Gardarene canine and incisors project 15 mm. in front of O'Brien's teeth, but, as already explained, much of this excess is due to faulty reconstruction. The depth of the body (at the second molar) is almost the

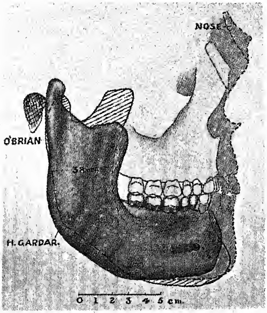


Fig. 180.—The mandible of giant O'Brien superimposed on the Gardarene specimen. O'Brien's face is lighter in shading.

same in both, but the angle of the Gardarene mandible and the width of the ascending ramus are considerably greater than those of O'Brien's mandible. The Gardarene condyle rises above O'Brien's; his coronoid process, on the other hand, rises above that of the Gardarene jaw. In the acromegalic skull (fig. 177) the condyle and coronoid process are fashioned as in the Gardarene mandible. O'Brien's face, from nasion to chin, was 145 mm., 20 mm. less than the Gardarene man as reconstructed by Professor Hansen (fig. 176). The discrepancy between the two mandibles is due first to a

difference in age; O'Brien was 22 years; Professor Hansen has estimated that the Gardarene man must have been between 40 and 50 years of age at the time of death. Growth continues in giants long after maturity is reached. The mandible of the Gardarene man is more harmoniously developed in all its parts than in any giant known to me.

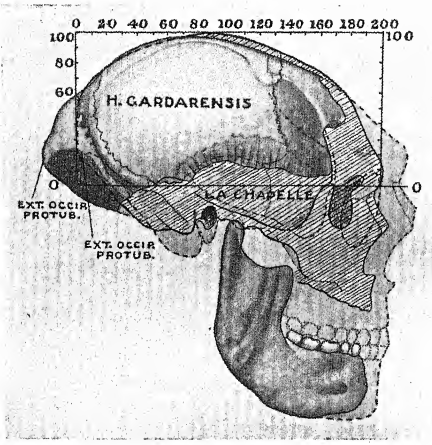


Fig. 181.—The Gardarene cranium superimposed on an outline of the La Chapelle skull (shaded by lines).

Nevertheless, had I only the mandible to guide me, I should conclude that *Homo gardarensis* was an acromegalic giant.

Let us now make a rapid comparison between the Gardarene cranial fragment and the corresponding part of three skulls. In fig. 181 the fragment has been superimposed upon the outline of the La Chapelle (Neanderthal) skull. In height, length and curvature the parietal

bones of the two specimens are in fair agreement. Both skulls are low-vaulted. The occipital bones and the areas for attachment of the neck present many resemblances, save that the occipital protuberance of the Gardarene skull projects 25 mm. (an inch) further back than that of the La Chapelle skull. The Gardarene forehead also projects more forwards and the face is longer. There are, as Professor Hansen maintains, many points of resem-

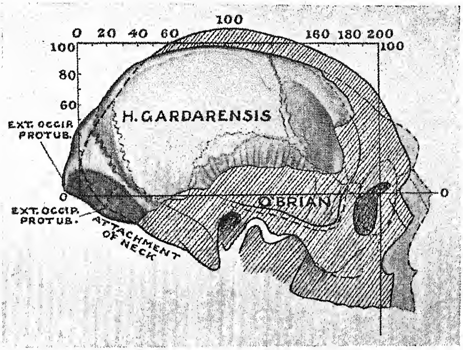


FIG. 182.—An outline of O'Brien—the Irish giant's—skull, with the Gardarene skull superimposed. O'Brien's skull is shaded by lines.

blance between these two skulls, and there are critical differences.

O'Brien's skull is 217 mm. long—21 mm. shorter than that of the reconstructed Gardarene skull. When we superimpose the latter on O'Brien's skull we see that there is a very great difference in height of vault (fig. 182). The vault of the Irish skull is the higher by 10 mm. We again notice a circumstance to which we shall recur, the greater backward projection of the Gardarene occiput (fig. 182). On the other hand, although the reconstructed forehead of the skull from Gardar does project in front

of O'Brien's glabellar region, it is doubtful if this should be the case, for on the Gardarene skull there is a distinct trace of the external angular process. O'Brien's external angular process lies in front of that of the Gardarene skull, which should not be the case if it was really a longer skull than O'Brien's.

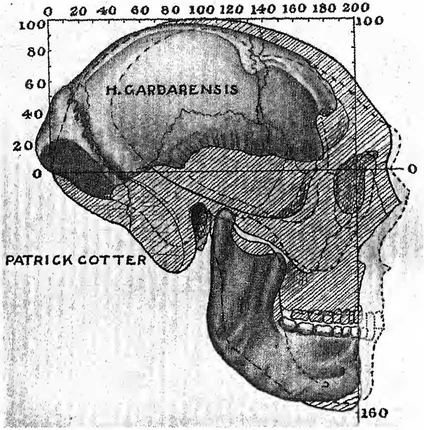


FIG. 183.—The Gardarene skull superimposed on the skull of Patrick Cotter, an Irish giant. The giant's skull is shaded by lines.

Lastly, we come to compare the Gardarene skull with the largest human skull known to me—that of Patrick Cotter, another Irish giant.[1] This skull had a length of 225 mm., but for such a length was low-vaulted, the highest point rising only 100 mm. above the subcerebral plane. In fig. 183 the Gardarene skull is superimposed

[1] This skull was described by Professor E. Fawcett, *Journ. Roy. Anthrop. Institute*, 1909, vol. 12, p. 196. Cotter's height is estimated to have been 8 ft. 4 in., and he died at the age of 46—a great age for a giant.

on that of Cotter; its occiput is seen to project far behind the giant's and to be situated on a higher level. On the other hand, there is a close agreement in the form and dimensions of the parietal and frontal bones. There is in particular another correspondence to which I attach much importance. In Cotter's skull and in O'Brien's it will be seen that the squama of the temporal bone has obtained a wide contact with the frontal bone—an

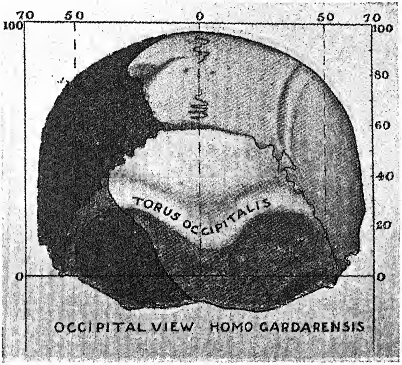


FIG. 184.—Occipital view of the Gardarene skull, reconstructed from Professor Hansen's photograph, which in the original is reproduced natural size.

articulation which is rare in normal skulls, but which is very common in the skulls of giants. Now, an examination of the sutures on the lower border of the frontal bone of the Gardarene skull (fig. 176, p. 485) provides evidence of a similar wide contact of the squama of the temporal with the frontal bone. In his reconstruction Professor Hansen has provided Gardarene man with an enormous mastoid process; such a process occurs in acromegalic skulls—especially those of acromegalic giants, but such large processes have never been seen in human skulls of

palaeolithic man. The evidence is forcing us more and more towards the view that the Gardarene skull is that of an acromegalic giant. Cotter's face was longer than that of the reconstructed Gardarene skull; it is the longest human face on record, namely 170 mm.

We have seen that in all our superimpositions the occiput of the Gardarene skull projects obstinately behind those of the cranial types selected for comparison

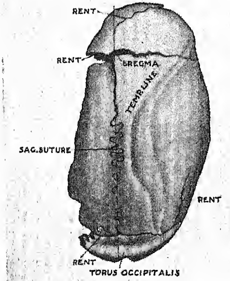


FIG. 185.—A tracing of the upper—vertex—aspect of the Gardarene skull. From Professor Hansen's photograph.

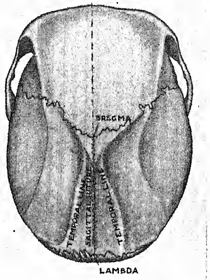


FIG. 186.—Drawing of the upper aspect of the skull of a man who was the subject of acromegaly.

and refuses to conform to them. The explanation of this discrepancy I discovered when I reconstructed an occipital view of the Gardarene skull from Professor Hansen's excellent photographs (fig. 184). The torus occipitalis is seen to be enormous—larger than in any palaeolithic skull. What impresses us most, however, is the extraordinary narrowness of the Gardarene skull as thus reconstructed; it is only 132 mm. wide, which represents 55·5 per cent. of the length—making the Gardarene skull the most dolichocephalic specimen ever seen. When we look at the occipital aspect (fig. 184), we see a gaping rent

opening into the vault at the site of the lambdoid suture as if the skull had been greatly compressed from side to side as it lay in the grave. When we look at the vertex of the Gardarene specimen (fig. 185), we see clear evidence of lateral distortion of the skull from earth pressure; not only has the lambdoid suture been pressed open, but so also has the coronal. The frontal bone and the occipital are bent towards the right side of the skull. A fissure, resulting from the slow action of superincumbent weight of soil, has formed along the frontal bone and another along the right parietal bone (fig. 185). If we restore or make allowance for the distortion due to earth compression, we must increase the width of the skull to more than 140 mm.—to probably about 146 mm., the width of O'Brien's skull. We have seen in our comparisons how anomalous the position of the occipital bone has been; with the rectification proposed the Gardarene skull becomes comparable in its occipital region with skulls represented in figs. 177, 182, 183. Its length, too, must be reduced by at least 10 mm. below Professor Hansen's estimate, thus making the Gardarene skull comparable in length to that of Patrick Cotter's skull.

In acromegaly and acromegalic giantism, the temporal muscles extend their origins upwards on the sides of the skull—a wave of growing bone growing in advance of the muscle. Such an extension is seen in the skulls of growing anthropoid apes. In the Gardarene man the temporal lines have almost reached the sagittal suture (fig. 185)—the position attained by the temporal lines in female gorillas. In fig. 186 is given an exact drawing of the skull of a man who suffered from acromegaly; in him the temporal lines have reached nearly to the sagittal suture. Further, at several parts of the surface of the Gardarene skull, especially the areas to which the muscles of the neck are attached, there are numerous minute outgrowths of bone—osteophytes—which occur on acromegalic skulls. On the lower jaw (fig. 178) are wave-like elevations of bone which betoken an irregularity in growth.

Thus we reach a very interesting conclusion regarding

the Gardarene skull. Professor Hansen has pointed out the great number of features in which this skull resembles the Rhodesian and La Chapelle skulls. Such features are certainly not pathological in these two palaeolithic skulls. The two skulls assuredly represent conditions which were normal in early types of mankind. I quite agree with Professor Hansen in all of these views. Where we disagree relates to the category or class to which *Homo gardarensis* is to be assigned. Professor Hansen would assign him to an unnamed type of humanity, one in which the features of early man have suddenly reappeared. It is an atavistic type. For my part I would assign *Homo gardarensis* to a well-known type—represented by those unfortunate beings who become the subject in youth of that pathological form of growth known as giantism, plus acromegaly—for giantism and acromegaly may occur together or they may occur separately. Both disorders result from a disturbance of the mechanisms which regulate the growth of the human body, and in both the pituitary gland passes into a pathological state. If I am right, then there must be hid away in the ancient cemetery of Gardar other bones of a giant, or of a man who suffered from an extreme degree of acromegaly.

The difference between Professor Hansen's opinion and my own as regards the nature of *Homo gardarensis* is not so great as the reader may be inclined to think. Why in certain young men and women the pituitary gland—and other glands concerned in growth—should become disordered in their action, we do not yet know. I should like to think the causes of giantism and of acromegaly are of a kind which will yet be discovered and prove capable of prevention or of successful treatment. I am far from saying heredity has nothing to do with the causation of giantism. Ireland has produced more than her fair share of giants, and there is a strong Norse strain in many parts of Ireland—just as in Iceland and Greenland. My comparison of the Gardar skull to Irish specimens of giantism may not be so far-fetched after all; both may be products of the same racial strain.

To me the chief interest of the discovery at Gardar lies in the fact that a human skull, manifestly of modern date, should reproduce so many resemblances to skulls of ancient palaeolithic man. It matters little as to what interpretation we give to the facts. It is manifest that there still exists in the living body of man a physiological system which controls growth and that this system which has come down from a remote ancestry still works in us and can be modified in its action. Under circumstances which we do not yet understand, this system of our bodies may suddenly revert to its ancient modes of action and reproduce ancient traits in modern man—acromegalic traits. A tall stature, however, is not a primitive feature. We have no reason to think that tallness was a characteristic of early types of humanity.

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